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**REPORT AND PRELIMINARY RESULTS OF R/V POSEIDON CRUISE P339,
Piräus - Messina, 16 June - 2 July 2006.
CAPPUCCINO - Calabrian and Adriatic palaeoproductivity
and climatic variability in the last two millenia.**

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R/V POSEIDON
Cruise Report P339

CAPPUCCINO
Calabrian and Adriatic Palaeoproductivity and climatic variability in the last two millenia

P339
Piräus – Messina
16 June – 2 July 2006

Cruise within the framework of the DFG/NWO financed intenational Graduate College: EUROPROX: “Proxies in Earth History” and the EuroMARC (ESF) project. MOCCHA: “Multidisciplinary study of continental/ocean climate dynamics using high-resolution records from the Eastern Mediterranean”.

1. Participants

Name	Discipline	Institution
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Figure 1. Scientific Crew

2. Research Program

2.1 Introduction

To date, there is an intense discussion among scientists, economists and politicians about the extent to which human activities and/or natural processes influence global climate change. One of the key publications within this discussion was published by Mann et al. in 1999 (Mann et al. 1999)in which a global temperature reconstruction of the last 1000 years is presented. This curve became widely known as the, so called, “hockey-stick”. It shows relatively stable global temperatures until about 100 years ago and an extreme temperature increase in coherence with an anthropogenic induced increase of atmospheric [CO_2] for the last century. However, over the last years it has become clear that global temperatures have not been as stable as suggested by Mann et al. (1998). For instance recently Moberg et al. (2005) showed that during the last 2000 years pronounced temperature fluctuations have taken place that have no equivalent in the atmospheric [CO_2]. This suggests that “natural” processes might have a stronger impact on short term climatic change than previously thought.

One of the natural forces that can influence climate on short time-scales is variation in solar insolation. This variation is known to occur in quasicycles of ~11 (sunspot or Schwabe cycles), ~22 (Hale cycles), ~80 (Gleissberg cycles) and ~200 (Suess cycles) years. Although variation in the amount of insolation in itself cannot account for the pronounced changes in Holocene climates, positive feedback mechanisms related to the amount of solar UV emission, and cosmic ray intensity can amplify the solar forcing. For instance, climate-models suggest a strengthening of the stratospheric winds with a more pole ward displacement of the Hadley cells and of the westerlies as result of increased UV emission. (e.g. Haigh 1996). Apart from quasicyclic changes, the European climate also changes in a more “chaotic” way related to the North Atlantic Oscillation (NAO) and its recent homologue, the Arctic Oscillation/Northern Hemisphere annular mode (AO/NAM) as well as the El Niño/Southern Oscillation (ENSO) (e.g. Wanner et al. 2001).

To estimate the natural and human-induced climate forcing today, we urgently need palaeoclimatic reconstructions of industrial and pre-industrial times with a high temporal resolution and accuracy. To date, the majority of these records are of terrestrial origin, whereas most of our globe is covered with water and as such our view must be strongly biased. Moreover, the “land-records” cover short time intervals only. The compilation of these records using methods like wiggle-matching, have the disadvantage that larger scale climatic variations are damped, and are not reflected in the compiled reconstructions. Records covering long time intervals are no exception in the marine environment. However, marine records of regions with sedimentation rates high enough to detect the above mentioned high frequency fluctuations are extremely rare.

A region where sediments are deposited during the last 5000 years with sedimentation rates high enough to cover this resolution is the Gallipoli Terrace in the Golfo di Taranto (Ionian Sea). Here sedimentation rates of 0.0645 ± 0.0007 cm y^{-1} are found (e.g. Cini Castagnoli et al. 1998). The Gallipoli Terrace is located downwind of the South-Italian volcanism and as a result its sediments contain numerous ash layers allowing detailed dating of these sediments (Cini Castagnoli et al. 1993). The discreteness of the ash layers indicates low bioturbation so that a temporal resolution sampling of the sediments of less than four years is achieved (Cini Castagnoli et al. 1990). Previous studies on the thermoluminescence and carbonate contents of the sediments as well as the stable oxygen and carbon isotopes of planktic foraminifera showed a reflection of the Schwabe, Hale, Gleissberg und Suess Cycles (e.g. (Cini Castagnoli et al. 1997;Cini Castagnoli et al. 2002a;Cini Castagnoli et al. 2002b). However, despite the recognition of these cycles the environmental changes relating to them (e.g. temperature, salinity or productivity) are far from understood. We plan to establish detailed palaeoceanographic reconstructions with a multi proxy approach using micropalaeontological proxies (pollen/spores, organic- and calcareous walled dinoflagellate cysts, benthic and planktic foraminifera and stable oxygen and carbonate isotopes and chemical tracers (e.g. Mg/Ca) of the calcareous microfossils as well as sedimentological, chemical (trace elements, stable nitrogen isotopes) and organic-geochemical proxies (Biomarkers, $U_k^{'37}$). Since previous investigations have consumed all available core material from the Gallipoli Terrace, we intent to re-collected cores from 8 sites in the Golfo di Taranto (Fig. 2). Within this project a national and international team of scientist will join their expertise mainly under the umbrella of the European Graduate College Proxies in Earth History (EUROPROX).

The results of the above cited studies suggest that changes in local SST, SSS and upper ocean bioproductivity might have caused the observed fluctuations in carbonate content and stable oxygen and carbon isotopes. The study area is located at the transition between the subtropical high-pressure belt and mid-latitude westerlies and as a result its climate is associated with upper air circulation and thus sensitive to relocation of storm-tracks, especially in winter (Trigo et al. 2002). Cyclogenesis is notably strong in southern Italy, and the Gulf of Genoa (Trigo et al. 1999). Solar insolation induced changes in the high and low pressure field location and intensity as well as the displacement of the track of the westerlies,

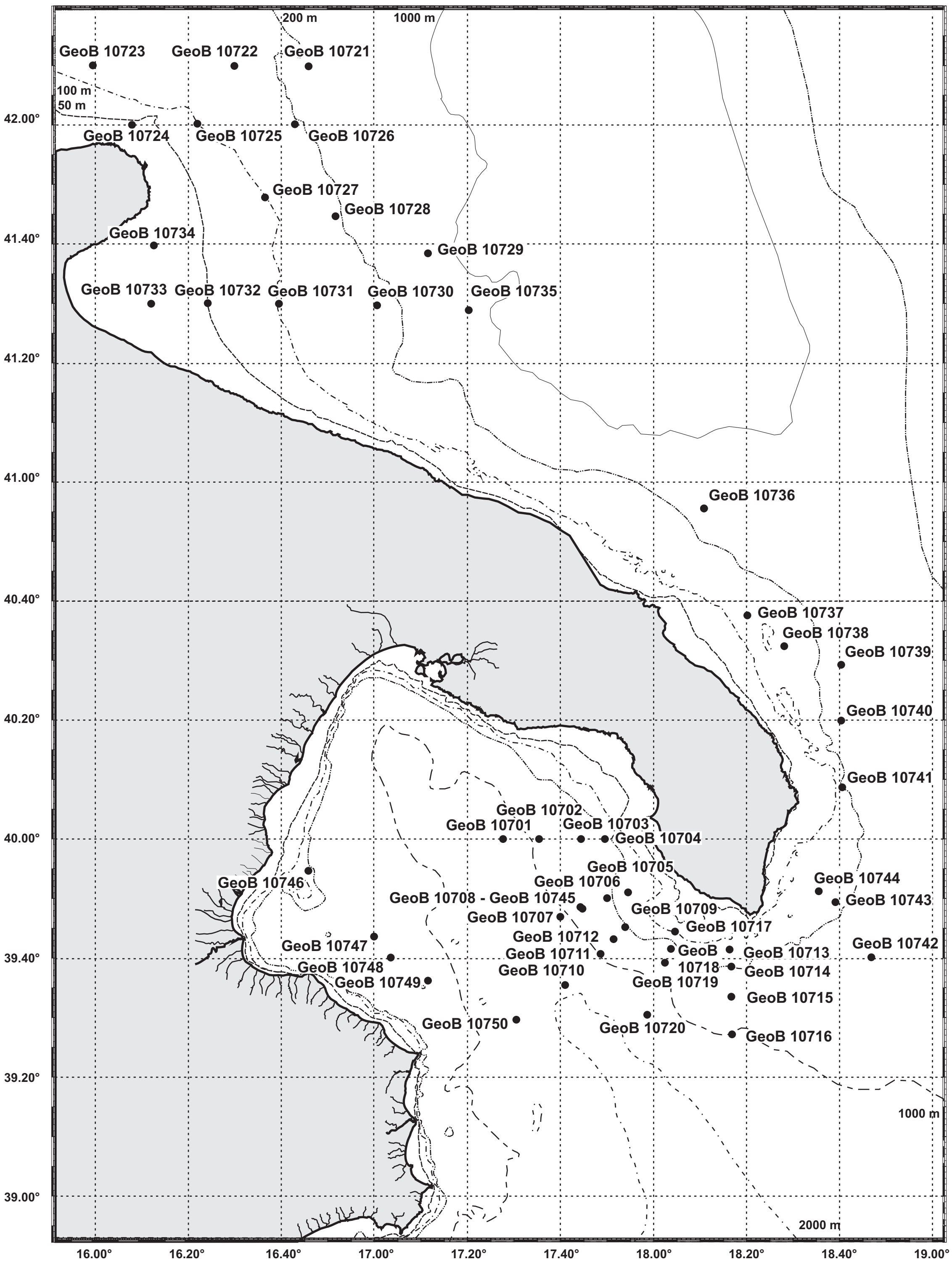


Figure 2. Map of the southern Adriatic Sea and the Golf of Taranto depicting sample positions

will have pronounced effects on local climate (e.g. cyclogenesis, amount and distribution of precipitation) and as such on the local palaeoceanography.

Satellite sea-surface colour measurements for the Golfo di Taranto show highest chlorophyll concentrations during 'winter' largely related to wind speed and river discharge. In autumn, increasing wind speed causes deep mixing supplying nutrients to the photic zone which enhances productivity (Grbec and Morovic 1997). In spring, wind speed reduces, stratification re-establishes and productivity decreases again.

Land derived nutrients and fresh water are brought into the Gulf by local rivers located at its west- and north-western side. In the south-eastern part of the Gulf surface waters can bear traces of the distal part of Po-discharge water that has found its way south all along the eastern coast of the Italian peninsula (Orlic et al. 1992).

To obtain reliable palaeoceanographic reconstructions of the region it is essential to tune our proxies on present day local environmental conditions. Therefore, surface sediment samples and upper ocean water samples have been collected on transects along environmental gradients, notably SSS and nutrient concentrations in the upper water column.

Since surface waters of the Gallipoli Terrace bear traces of the distal part of the Po-discharge “plume”, past changes in Po-discharge might have influenced oceanographic conditions at the coring sites. To enable recognition of such changes, detailed information has to be achieved about the present day signature of the discharge plume. We therefore collectd surface sediment and upper water samples along a transect from the Gallipoli Terrace, around the Calabrian peninsula towards the north along the eastern Italian coast.

The Po-river is one of the major sources of nutrient input into the ultra-oligotrophic Eastern Mediterranean Sea (including the Adriatic Sea). With exception of the eastern Italian coastal region the Adriatic Sea is characterised by extreme low bioproduction (6-12 g C m^{-2} a^{-1}) and as result extreme low organic matter accumulation. This region is therefore an example for an ecosystem in which regeneration of nutrients is of major importance and where nutrients are being recycled within a microbial loop in the upper sediments and nepheloid layer (Krom et al., 1992; Yacobi et al, 1995; Zohary and Robarts, 1998). The region is unique by its considerable discrepancy of Nitrate and Phosphate concentrations in the individual water layers with that of the Redfield Ratio (25.28:1 in contrast to 16:1 in the Atlantic Ocean; Redfield et al., 1963). Possible causes are considered to be (a) reduced primary production as caused by a nitrate and phosphate input that differs from the Redfield relation, (b) phosphate loss by adsorption of phosphate on FeOOH rich dust particles or (c) overprint of the signal by considerable nitrogen-fixation from the atmosphere by diazotrophic nitrogen-fixating bacteria. Based on the observation that sediments and suspended material in the

Eastern Mediterranean Sea have an a-typical low $\delta^{15}N$ signature suggest that phosphate limitation rather than N_2-fixation might be the cause for the above described discrepancy. However, $\delta^{15}N$ data of Pantoja et al. (2002) contest these suggestions. To obtain more insight in nitrogen dynamic in the Eastern Mediterranean Sea (including the Adriatic Sea) the the chemical and organic-components as well as stabile N-isotopes of surface sediments and suspended material within the water column will be analysed.

2.2 Aims

The main purpose of Poseidon cruise P339 was to collect samples and data from the coastal area's of the southwestern Adriatic Sea and the Golfi di Taranto. These samples and data form the basis of several research themes that are being carried out in the scope of the Deutsche Forschungsgemeinschaft (DFG) sponsored European Graduate College "Proxies in Earth History (EUROPROX) and the European funded project MOCCHA. The samples will allow:

(1) Establishment of detailed, high temporal resolution palaeoceanographic and palaeoclimatic reconstructions of the southern Italian region of the last 2000 years using a multi-proxy approach with the aim to obtain insight in the rate of anthropogenic and natural force on global climate. Emphasis will be given to high temporal frequency variation in climate and its possible relation to variability of solar insolation.

(2) Tune the, to be used proxies based on organic- and calcareous microfossils, chemical elements, organic biomarkers in surface sediments and upper waters with physical parameters of the upper water column on.

(3) Obtain insight in the remineralisation processes within the high productivity region of Po-discharge area and the extreme oligotrophic southern Adriatic Sea. Emphasis will be given to the question if the low $\delta^{15}N$ signatures of bottom sediments and suspended material in the water column of the Eastern Mediterranean as well as the a-typical Redfield Ratio of this region (P:N of 25-28:1 in contrast to 16:1 for the Atlantic Ocean) are the result of (a) reduced primary production as caused by a nitrate and phosphate input that differs from the Redfield relation, (b) phosphate loss by absorption of phosphate on dust particles or (c) overprint of the signal by additional nitrogen fixation from the atmosphere. For this, surface sediments and water samples will be collected along several transects from the Italian shelf into the deep basin in the northern part of the South Adriatic Sea. We plan to sample suspended matter, surface sediment and water for analyses of $^{15}N/^{14}N$ ratios of dissolved and particulate nitrate.

To achieve these goals, sediment cores from 11 sites have been recovered using a 6m gravity core (Chapter 3.3.1., Table 1.). Surface waters at 49 sites along onshore-offshore transect covering oligotrophic – eutrophic gradients in the distal part of the high productivity area that can be related to the Po-river discharge plume have been sampled using a CTD/Rosette and a plankton net (Chapter 3.2). Of all sample sites surface sediments have been collected using a multicorer (Chapter 3.3).

Figure 3. Research Vessel POSEIDON (upper left), Gravity Core device (upper right), Multicore device (lower left), CTD/Rosette (lower right).

2.3 Narrative of the Cruise

Just before departure it appeared that our Italian colleague from the University of Torino was not be able to participate in the cruise as result of health problems.

After departure on June 16th we had 1½ days of transit prior to arrival at the first sampling station. The time was used to discuss the goals of the cruise, to bring everybody at the same level of understanding, for unpacking, install and test the equipment, and to connect to the ships' computer network. It appeared that the thermosalinograph, the ships log GPS and the multibeam systems were malfunctioning or broken and attempts to revive them failed. Although it would have been helpfull to have this equipment available, the success of the cruise did not depend on these systems. The transit was highlighted by the passing of the Corinth Channel, adding a bit of 'holyday feeling'.

Early on June 18th we arrived at our first and deepest station of the first transect and at UTC 4:00 our brand-new Rosette/CTD was successfully deployed. Water was collected from bottom, intermediate and surface waters for nitrogen analyses, and plankton was collected from the thermocline. A plankton net was used to sample the upper 10 m for plankton > 10 µm. The sample appeared extremely rich in dinoflagellates, including cysts, whereas only few diatoms were present. Subsequent multicorer deployment recovered clayey to silty sediments with about 10 cm of oxygenated penetration from the sediment surface and bioturbation. Living dinoflagellate cysts were almost absent in the sediment surface samples so that it was decided to set up dinoflagellate cultures from the surface water plankton samples. Gravity coring was also successful and provided 2.5 m of core, including the oxygenated sediment surface from a 3 m core with 300 kg weight. The second station also was successful and provided CTD, Plankton and surface sediments. The third station at 40°00N, 17°44.47'E was very close to the location of Italian core GT91/1 (39°.59.78'N,17°45.87'E). It was deployed as the first one except for the gravity core. On the basis of the sediment conditions of the first station its length was increased and we successfully collected almost 4 m of sediment using a 6m corer with 300 kg weight and 1.5 m downward speed. During the night bottom profiling of the remainder of the first transect and the entire second transect was performed using the ships' .18 kHz "sedimentlot" system. The obtained insight in the sea floor topography resulted in relocation of some of stations to more promising sites.

On June 19th we started with the last and shallowest station of the 1st transect. This included the first station for which our Italian colleagues asked for core material (Station 10704). Conversely, two gravity cores were taken both with success. One multicore was frozen for later analysis of proxies vulnerable to diagenetic processes. A strategy we would follow for every station where gravity cores would be collected. The rest of the day was consumed by sampling the shallowest stations of the 2nd transect just south of the first transect (stations 5 and 6). At station 6 (close to Italian core site GT94/2) a core was recovered for our Italian colleagues again. During the night logging of the sediment surface topography of the 3rd and 4th transects with the 18 kHz echo sounder system was scheduled. The system, however, broke early in the evening, and we reverted to logging the depth information manually by storing the depth-reading from the 30 kHz echo sounder system every 15 s. The shallowest depths were obtained by reverting to the 12kHz deep-sea echo system.

On June 20th both remaining deeper stations of the second transect (stations 7 and 8) were successfully sampled. Subsequently, the main station of the Gallipoli section (at the location of Italian cores GT14, GT89/3 and GT90/3) of the cruise was sampled. The sampling was a success and by the end of the day everybody was satisfied, happy and tired.

June 21st started with the sampling the deepest stations of the third transect, starting with Station GeoB107010 at 2000m, the first station with a turbidite in the box-core. A gravity core with plastic liner came out well. At 180 cm a darker section started which has been sampled. After this station, a security exercise was carried out.

During the evening and night, depth-profiling of transects four and five were carried out using the same procedure as described before but without the need to rely on the 12 kHz system for the shallowest depths. The sample stations were planned from these profiles.

June 22nd started like all previous days on the ship with perfect weather and almost no waves. Early in the morning the first of four CTD/MUC station was taken at the shallowest site of the fourth transect (station GeoB10713) and the last station was finished at 16:00 (GeoB10716). All samples were much sandier than at the three previous transects.

June 23rd today our last (5th) transect was taken in the Gallipoli region (GeoB10717-20). The first station being close to the location of GT94/3. The sediments and accompanying benthic foraminifera association resembled an open eastern Mediterranean setting with coarser sediments and deep oxygen penetration. At the end of the day the ship set off to the northern region, at sunset we rounded the southern tip of the Italian heel, Capo Santa Maria di Leuca.

June 24th was used compiling the data collected during the first part of the cruise. In the afternoon a meeting was organised to present preliminary results and to discuss the goals for the next days. After dinner depth profiling of the next transect started.

June 25th; nice weather again. The northernmost stations of the cruise were taken (GeoB10721-25; representing transects 6 and the inner stations of transect 7). Some the shallowest stations were very muddy but near the 200m depth line coarse sands and oyster beds occurred at 10-20 cm in the sediment, efficiently preventing the MUC to recover sections longer than 25 cm and providing harsher conditions for obtaining proper cores. In this region the distances between the stations are larger. To minimise transit times, the stations of the transects were re-grouped on the basis of minimum distances, using the nights for the longer transits.

On June 26th we sampled GeoB10726 to 29, completing transect seven and sampling all but the inner sample of transect 8. Sampling along onshore-offshore transect in this region was hampered by the presence of numerous waste and ammunition depots. The sedimentology of transect 8 resembled that of transect 6 and 7 with sandy sediments at the 200 m isobath and fine grained mud at other depths. In the deeper basin we recovered a gravity core with very stiff clays and a darker layer at about 40 cm. Dinoflagellate analysis of the core bottom revealed an age of about 20 ka BP deposited under glacial conditions (e.g. *Spiniferites elongates*), whereas the darker region yielded foraminifera typical for anoxia related to deposition of sapropel S1.

June 27th During the night between 26th and 27th depth profiling was carried out. Sample positions were slightly relocated according to the results. The shallowest station of transect 9 (station GeoB10730) contained, consistent with all previous stations at about 200 m water depth, coarse sandy sediments. Moving progressively to the shore, the stations became more and more finely grained and the last two very shallow stations contained anoxic, partly black and very weak mud in the MUCs and gravity core. To avoid damage of the gravity corer we collected a 3 m only, weight 600 kg.

June 28th started like all previous days with fine weather and a quiet sea. After the first station (GeoB10735) the Italian authorities mixed with our planning and permission was withdraw for sampling the two outermost stations of transect 9 as well as two stations on transect 10. During the transit to more southward located stations, Gerd Schmiedl amused us with an excellent introduction on the benthic foraminifera and presented the first results on foraminifera assemblages in the surface sediments of the previous sample locations.

June 29th six shallow water stations on a south-southeastward transect (Stations 36-41) were collected. For the risk of collecting Albanian mines and the presence of ammunition deposits we decided to collect at relatively shallow depths only. As a result sampling went swiftly so that we could 'set sail' to the last transect 11 in the Street of Otranto in the afternoon. All samples contained clayey sediments often larded with shells. The evening and early night were spent by recording the water-depths along last transect and selecting the locations of next days stations.

During the morning hours of June 30th transect 11 was successfully sampled. In the early afternoon we set off to the former station 8 in the Golfo to Taranto where two gravity cores were collected. A foil core showed a darker section at about 3.8 m core depth which according to the benthic foraminifera assemblages had been deposited under anoxic conditions and as such could represent the S1 sapropel. During the transect Karin

Zonneveld gave an animating introduction in dinoflagellate biology and their use in palaeo-oceanographic research.

At July 1st, the last transect was sampled in the north-western part of the Golfo di Taranto. This transect should form a so called “reference transect” outside the Po-river discharge plume influence. The first MUC (taken close to the location of Italian boxcore GT94/22) proved very weak, uncompacted sediments. The high water content was confirmed by Schauna, who obtained the fastest pore-water extraction executed so far. Here results suggested extreme high sedimentation rates and it was decided to sample sediments using a gravity core. On our final station (50) the ship Poseidini was baptised. This ship that forms a satellite of the research vessel Poseidon was immediately tested for sea-going research and on the command of our captain its first water sample was successfully recovered and analysed on its planktonic content. Successively the scientific movie that documents research activities of the CAPPUCCINO cruise was analysed. After this we set off on a transit towards Messina.

Figure 4. Recovery of Multicores (upper left), water sampling for stable isotopic and elemental analysis (upper right), chemical analysis on pore water of a multicore (bottom).

3. Preliminary results

3.1. Underway hydroacoustics

Gerard Versteegh. Fachbereich 5-Geowissenschaften, Postfach 330440, D-28334 Bremen.

During the cruise P339 cores were collected at sites where information of the sediment composition and sedimentation rates was already known from the literature. Nevertheless detailed information about the ocean bottom topography was required to determine the exact core locations. Unfortunately at time of arrival of the scientific crew, the shipboard multibeam sonar SEA BEAM 1050 was malfunctioning and could not be repaired. Information on the ocean bottom morphology was obtained by using the shipboard 18 kHz sedimentlot" system. Unfortunately this "old lady" broke down as well, during the first survey, resulting in the loss of data for transect one and two. Information on the morphology of the ocean topography of the other transects has been collected "by hand". This has been done by sailing with 6 kn over the transect covering the planned station sites and registering every 15 second the water depth as well as at regular distances the ships coordinates. Based on these depth profiles the core sites were selected.

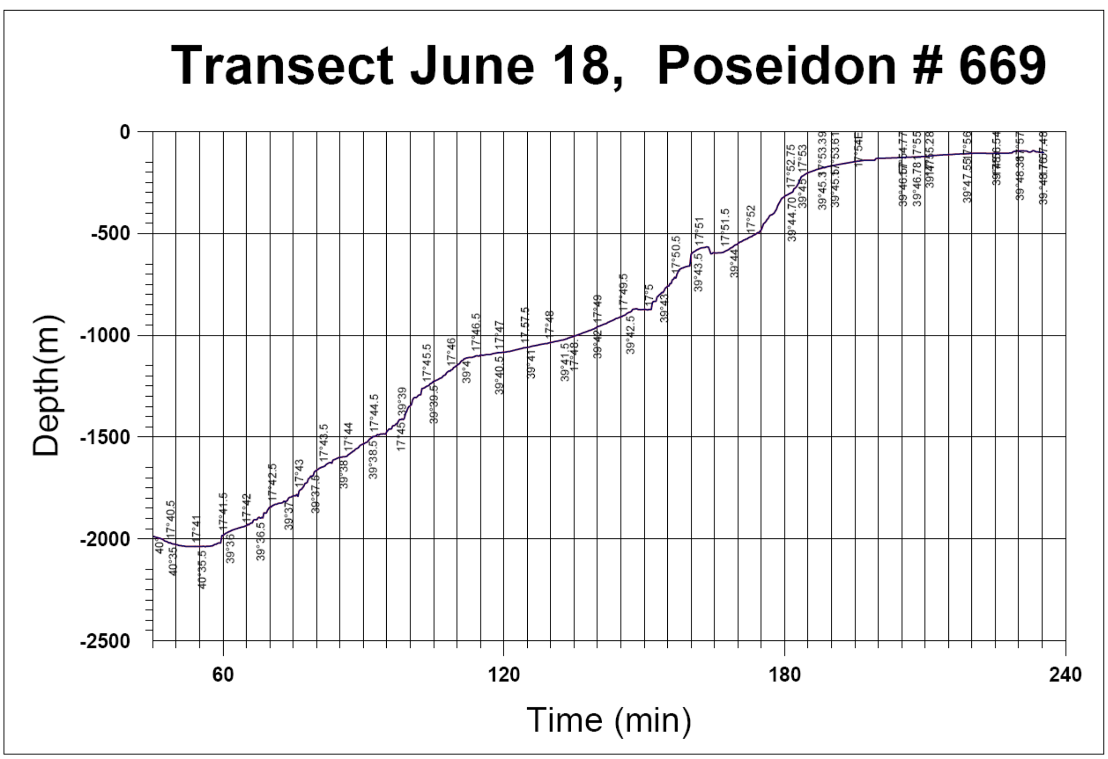


Figure 5. Depth transect 669 (Table1).

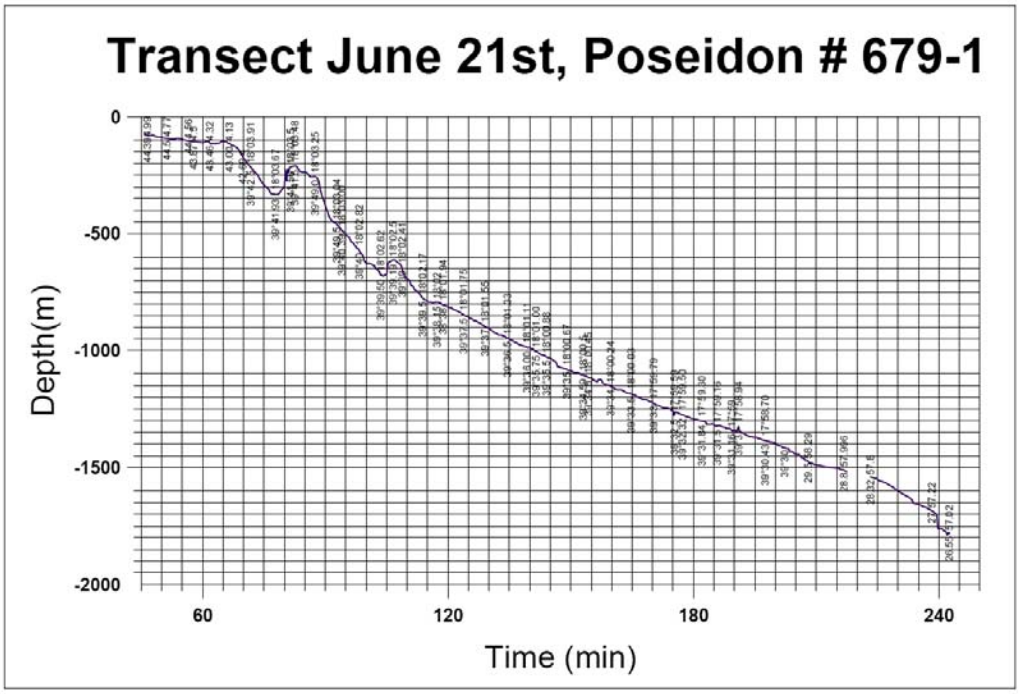


Figure 6. Depth transect 679-1 (Table 1).

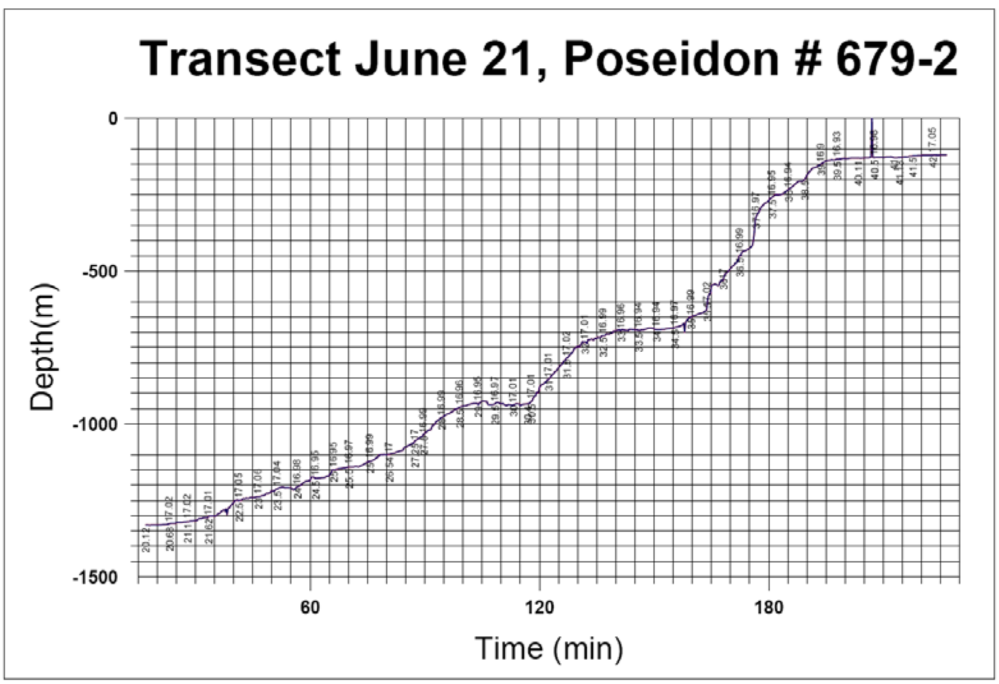


Figure 7. Depth transect 679-2 (Table 1).

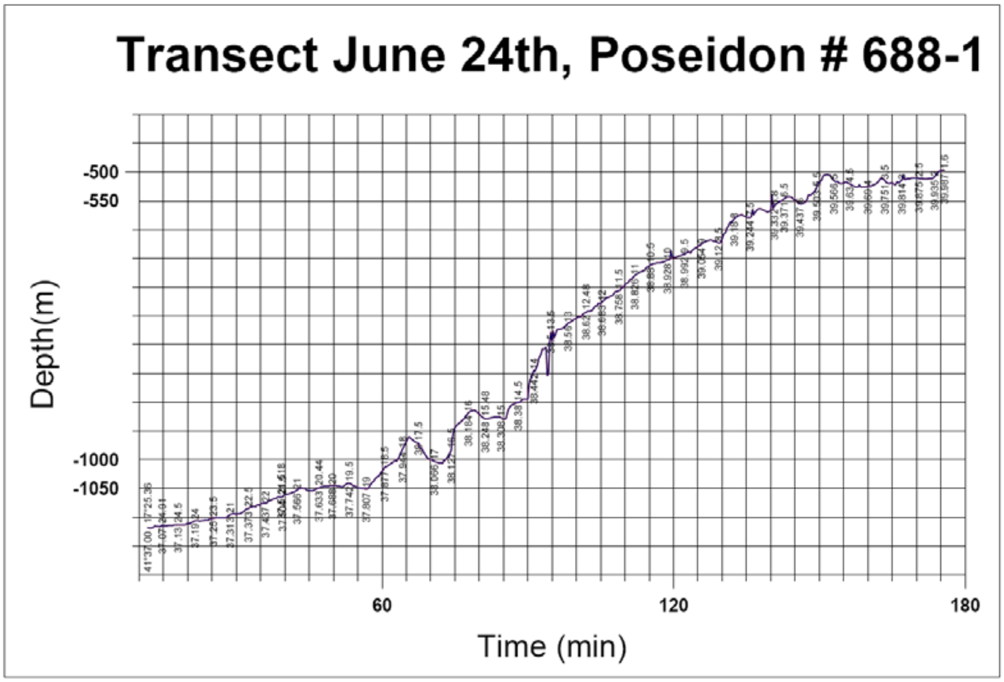


Figure 8. Depth transect 688-1 (Table 1).

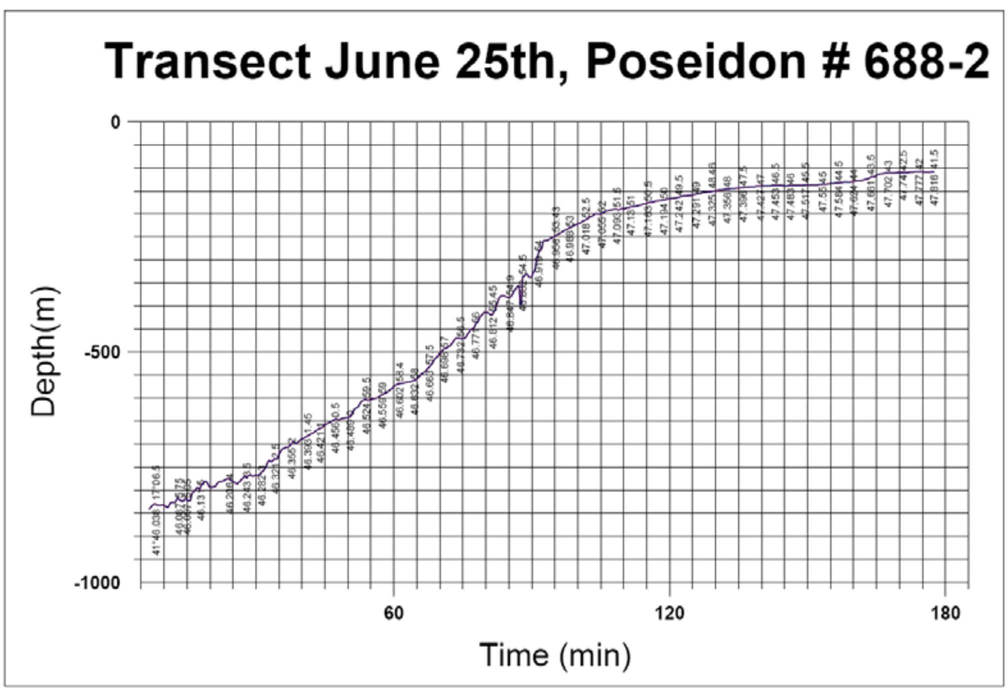


Figure 9. Depth transect 688-2 (Table 1).

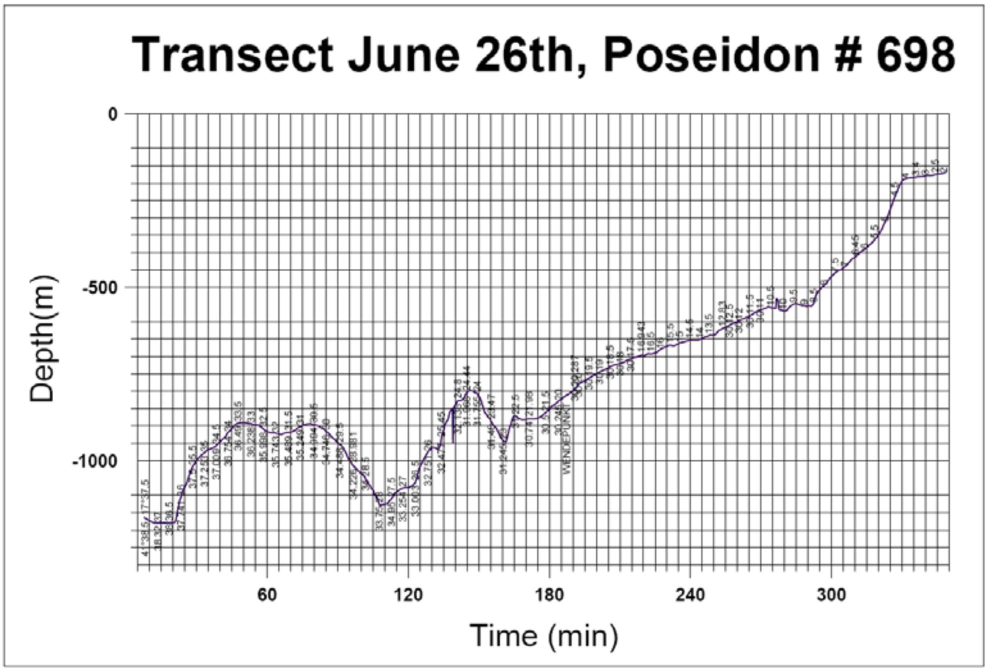


Figure 10. Depth transect 698 (Table 1).

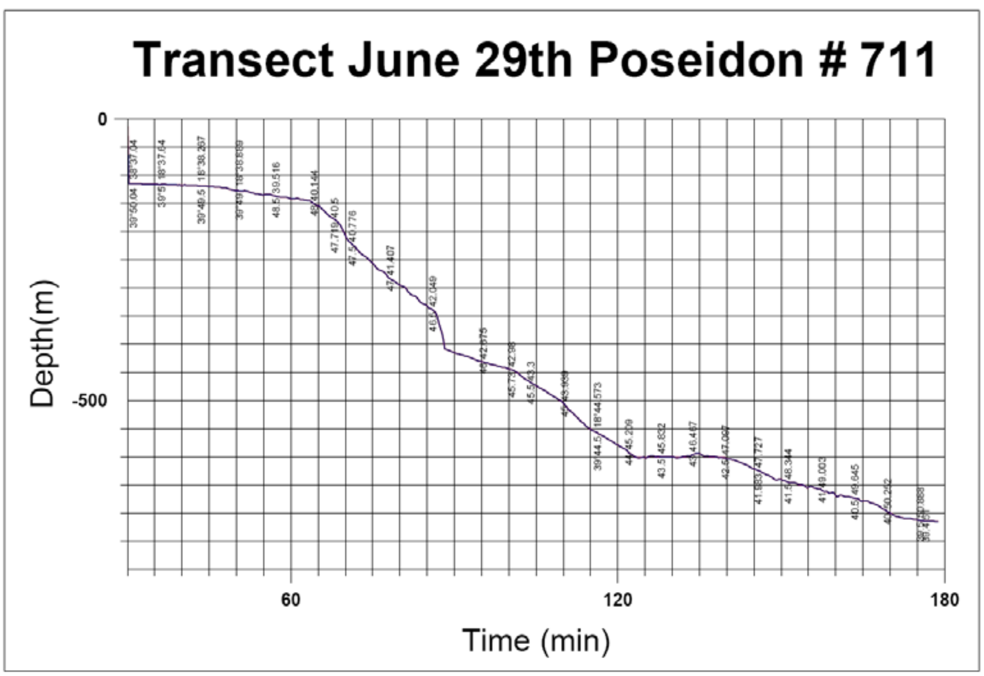


Figure 11. Depth transect 711 (Table 1).

3.2 Water column characteristics

Karin Zonneveld

The most prominent oceanographic surface water feature in the research area is the presence of the Po-river discharge plume. The Po-river is the largest Italian river draining the southern part of the alps and the northern part of Italy into the North Adriatic Sea, the northernmost part of the Mediterranean Sea. The river with a length of 673 km and drainage basin of 71,000 km^2 flows through one of the most productive agricultural and industrial regions of the country. Since the Po-river forms the primary source of nutrients to the Adriatic Sea, changes in amount and quality of the Po-river discharge has large effects on the marine environment (Penna et al. 2004). Massive dinoflagellate and diatom bloom, sometimes associated with red tides and toxicity are well known from the north-western Adriatic Sea (Boldrin et al. 2002;Boldrin et al. 2005;Boni et al. 1992;Boni et al. 2000). Small local Italian rivers that drain the Appenines, spice fresh, nutrient rich waters and suspended sediments into the plume. However, the loads of nutrients and sediments of these local rivers are considerably lower with respect to the Po River discharge (Penna et al. 2004).

The an anti-clockwise surface water circulation induced by Coriolis forcing cause that the fresh, nutrient rich Po-river discharge water is pressed against the western coastal margin of the Adriatic Sea forming a band of enhanced productivity reflected by high chlorophyll-a concentrations in surface waters that can be observed along the whole western margin of the Adriatic Sea, the Otranto Strait, around the Calabrian peninsula into the Golfo di Toranto. Classically these relative cool, nutrient and suspended matter rich, low salinity waters are classified as Adriatic Surface Water (ASW). Along the eastern side of the south Adriatic Sea and Otranto Strait high temperature, high salinity and low suspended matter and nutrient concentration Ionian Surface Water (ISW) coming from the Eastern Mediterranean enters the basin. Within the Golfo di Taranto,the circulation is generally cyclonic with ASW entering along the eastern part the basin. Within the Golfo a mixing between ASW and ISW occurs (e.g. (Lee et al. 2007;Socal et al. 1999); (Boldrin et al. 2005;Caroppo et al. 2006) and references in the Journal of geophysical research, vol. 112, 2007).

Intermediate waters are formed by the relatively nutrient rich, high salinity waters of the Levantine Intermediate Water with a salinity of more than 38.70 and a core of about 200m depth. In the Adriatic Sea a shift towards the cooler waters of the dense Adriatic Deep Water (ADW) occurs below about 600m depth. Along the Italian coast fresher but colder North Adriatic Dense Water (NADW) forms a southward flowing bottom water current. Both ADW and NADW are recognized as contributors to the eastern Mediterranean Deep Waters, although recently having competition by deep water that is produced in the Aegean Sea (e.g. (Grbec et al. 2007;Hainbucher et al. 2006;Sellschopp and Álvarez 2003).

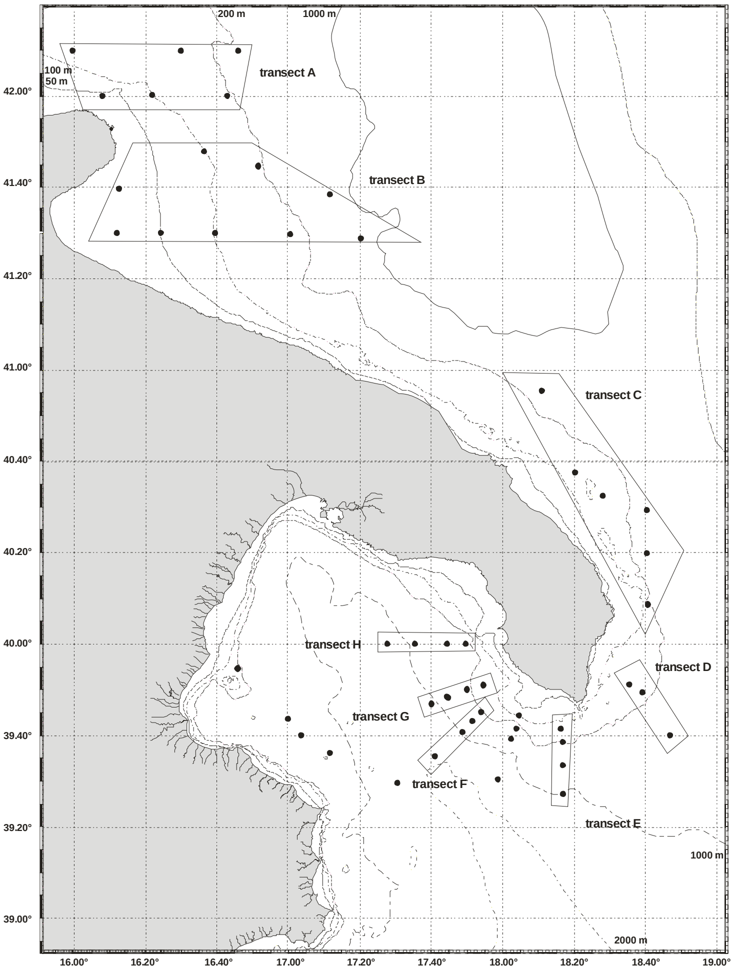


Figure 12. Map depicting the temperature transects

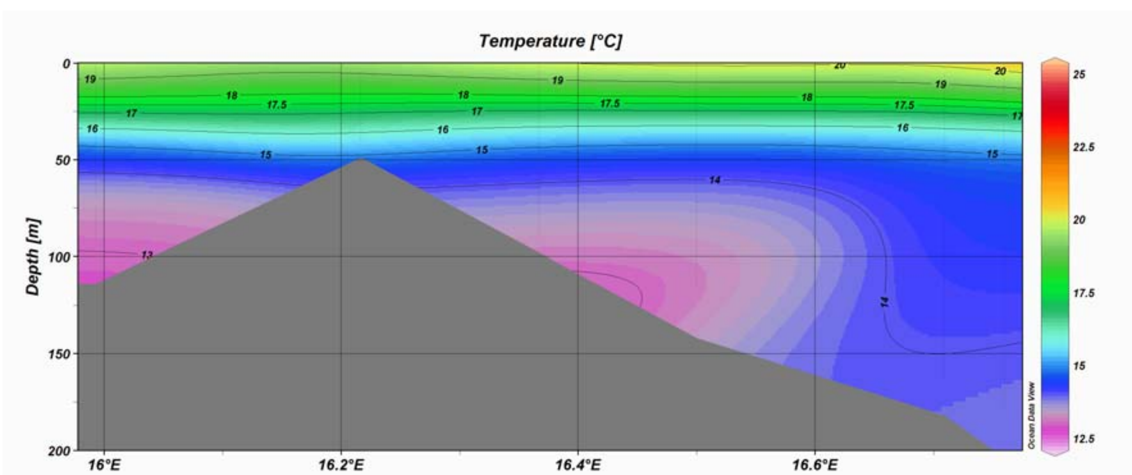


Figure 13. Temperature profile of transect A.

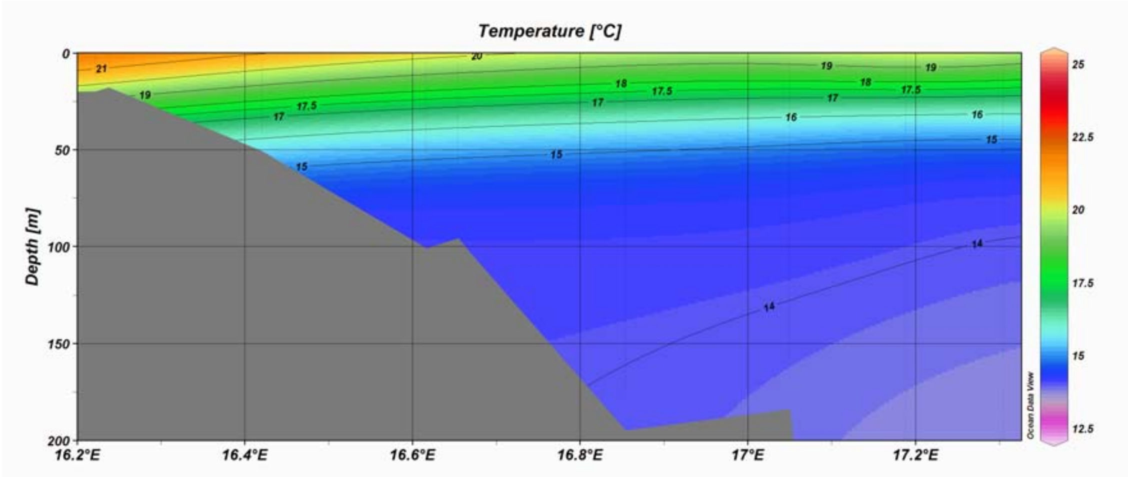


Figure 14. Temperature profile of transect B.

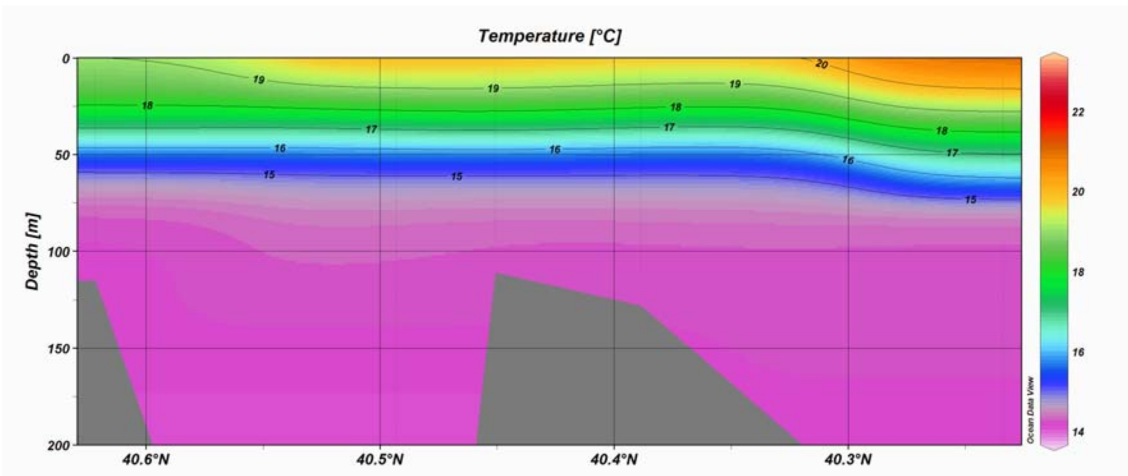


Figure 15. Temperature profile of transect C.

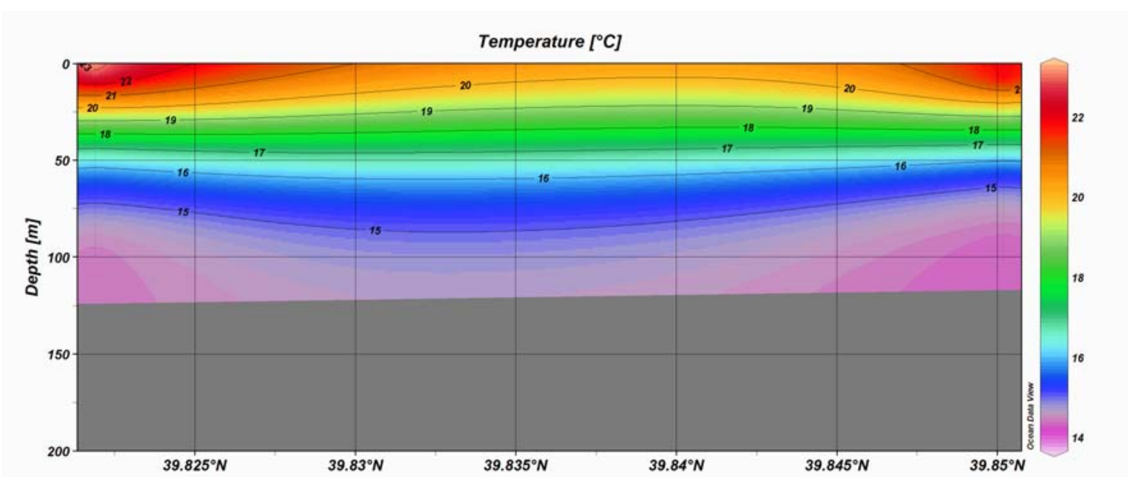


Figure 16. Temperature profile of transect D.

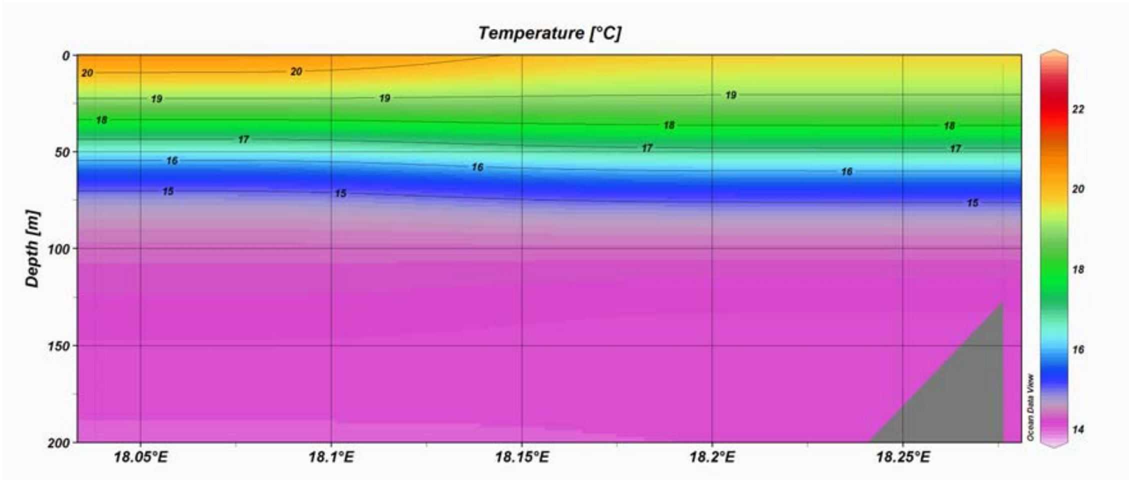


Figure 17. Temperature profile of transect E.

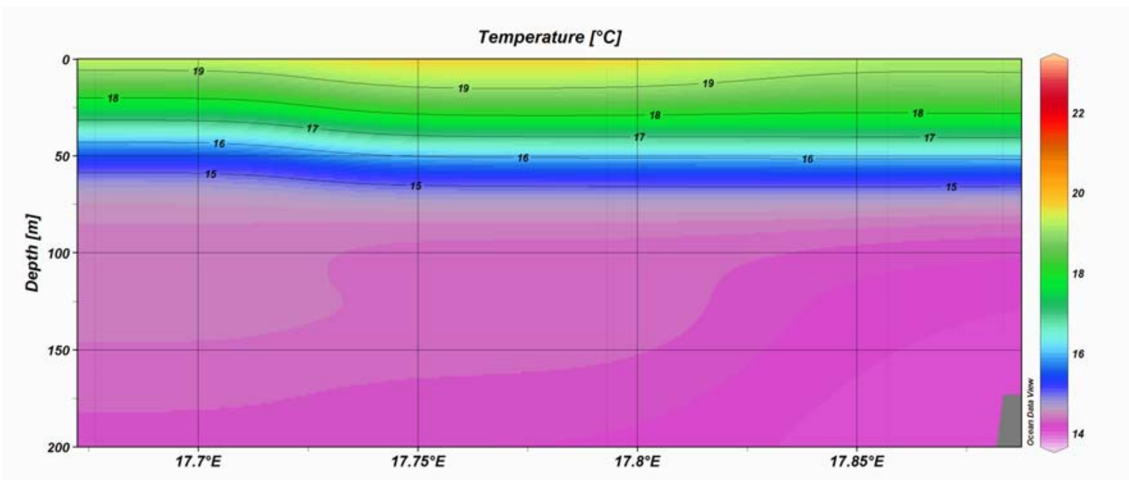


Figure 18. Temperature profile of transect F.

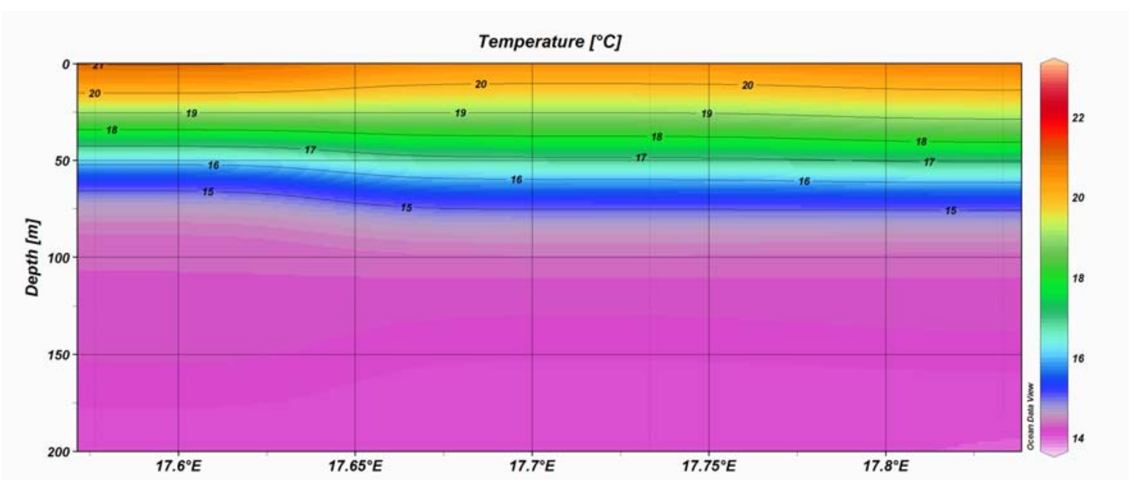


Figure 19. Temperature profile of transect G.

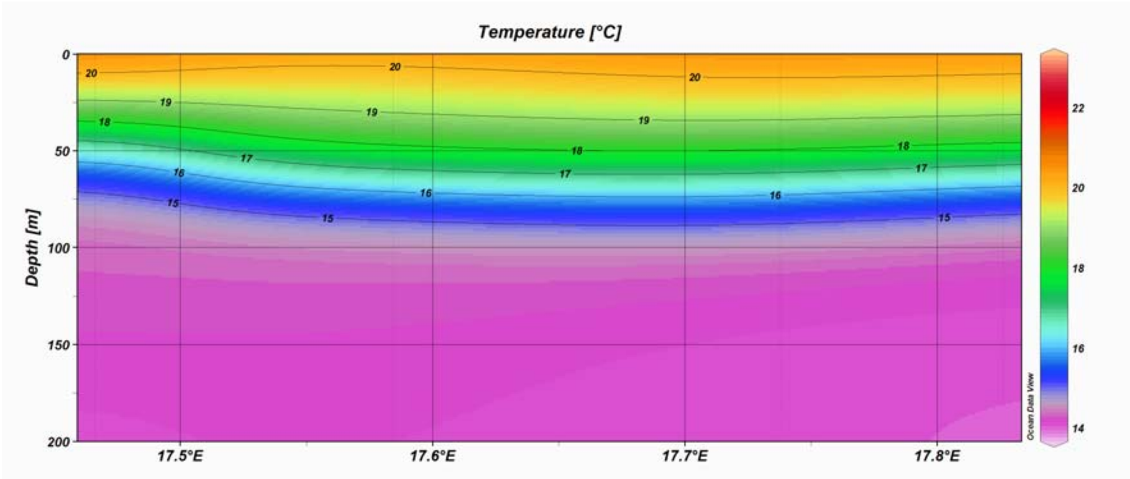


Figure 20. Temperature profile of transect H.

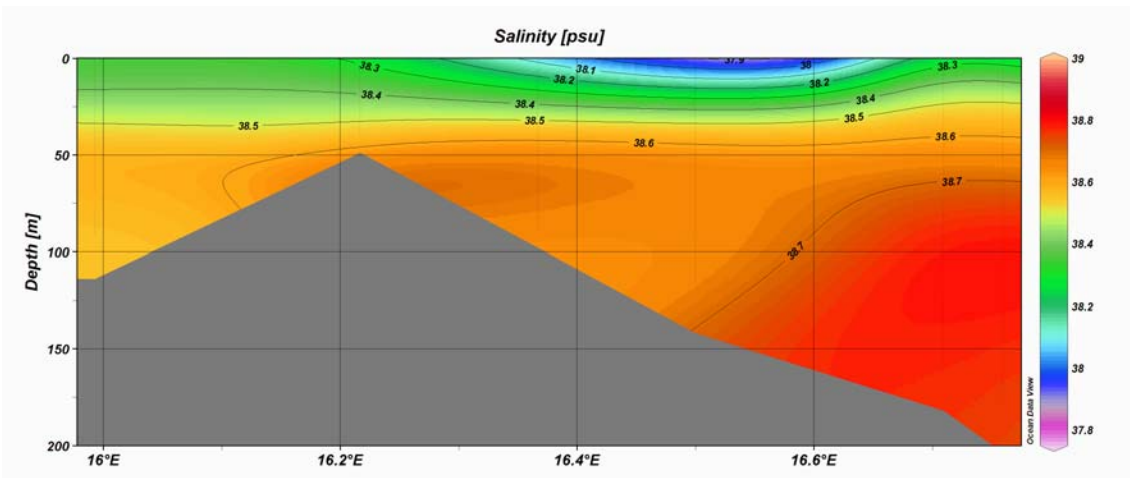


Figure 21. Salinity profile f transect A.

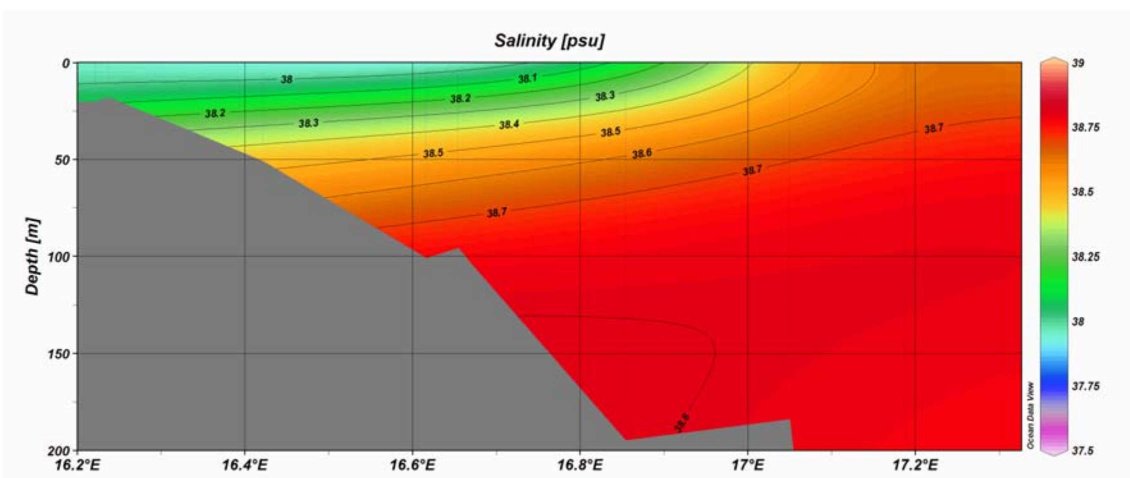


Figure 22. Salinity profile of transect B.

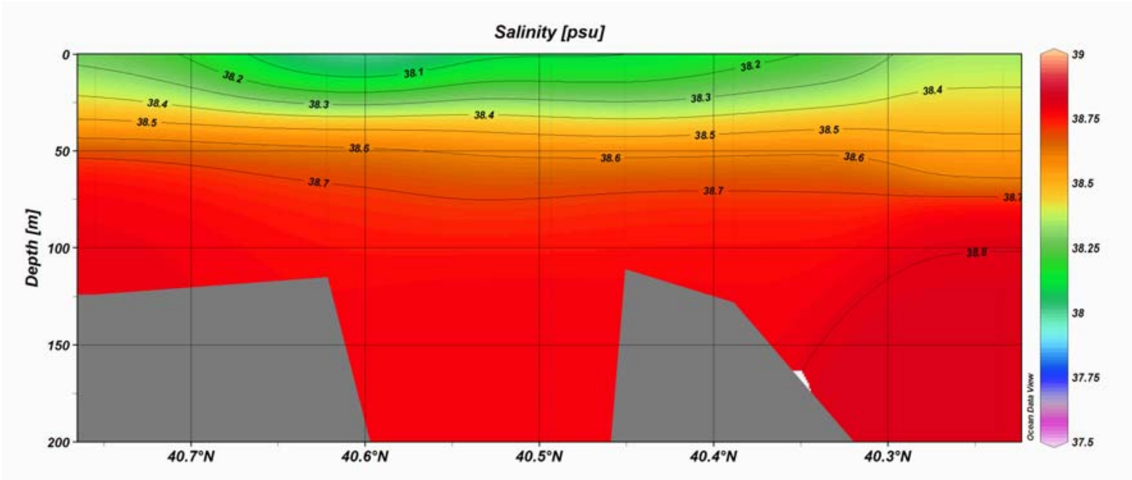


Figure 23. Salinity profile of transect C.

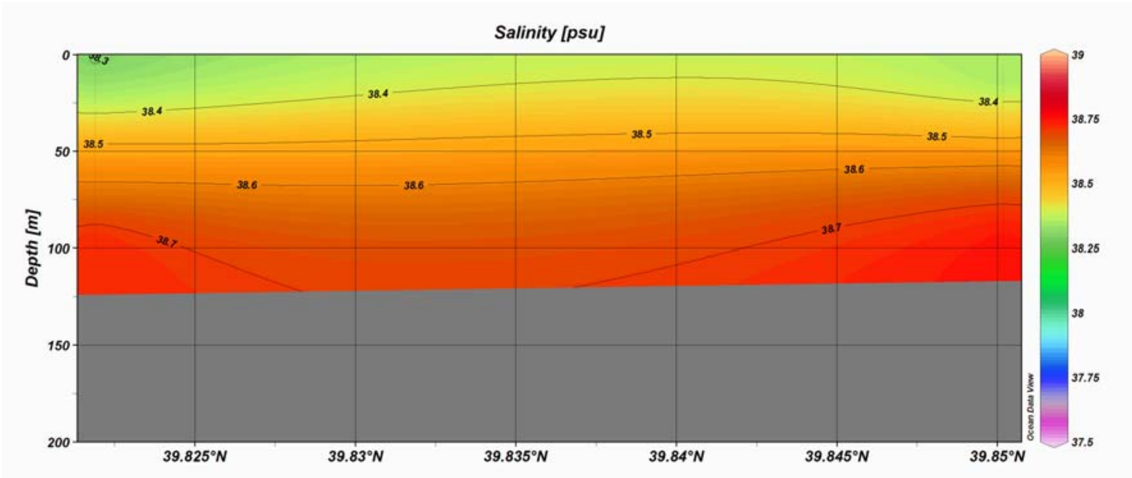


Figure 24. Salinity profile of transect D.

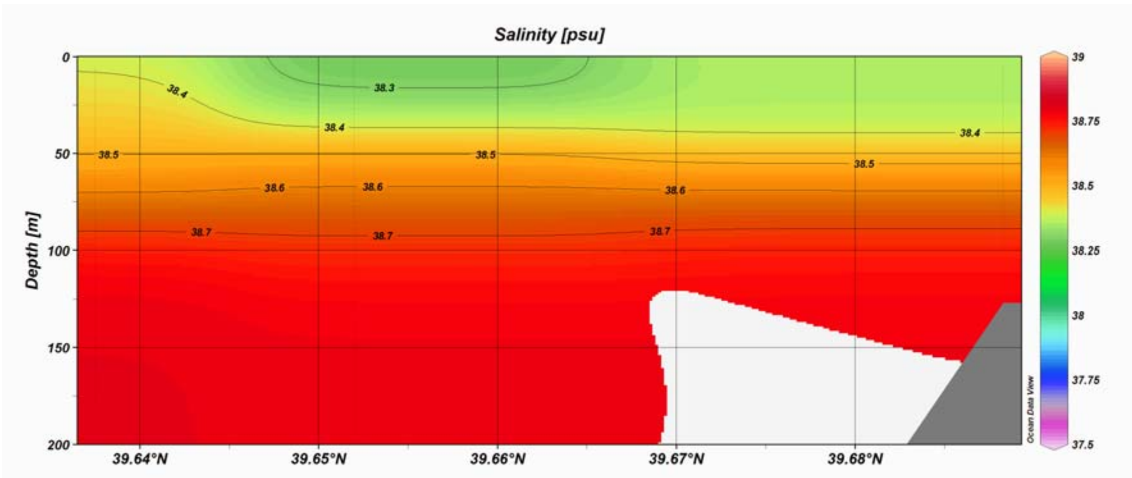


Figure 25. Salinity profile of transect E.

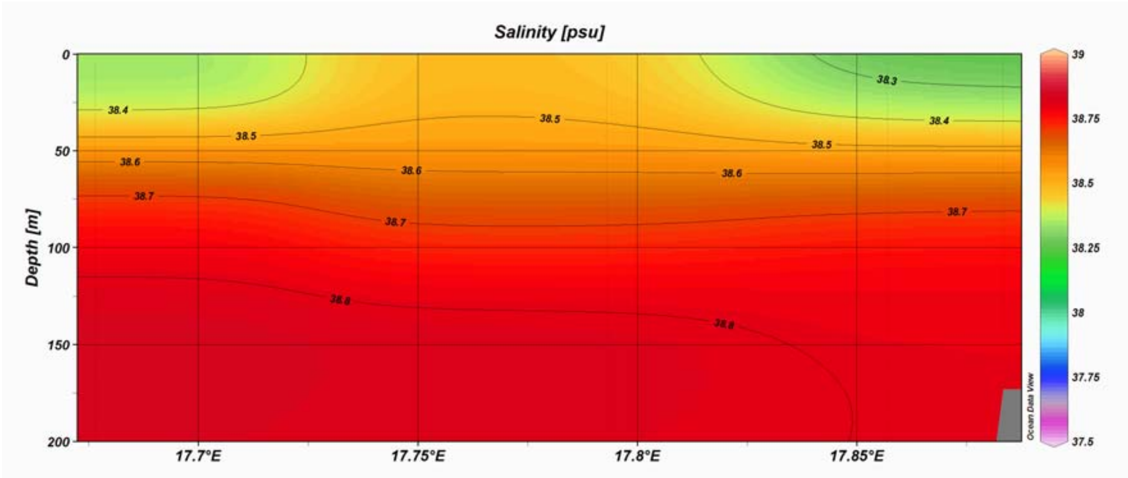


Figure 26. Salinity profile of transect F.

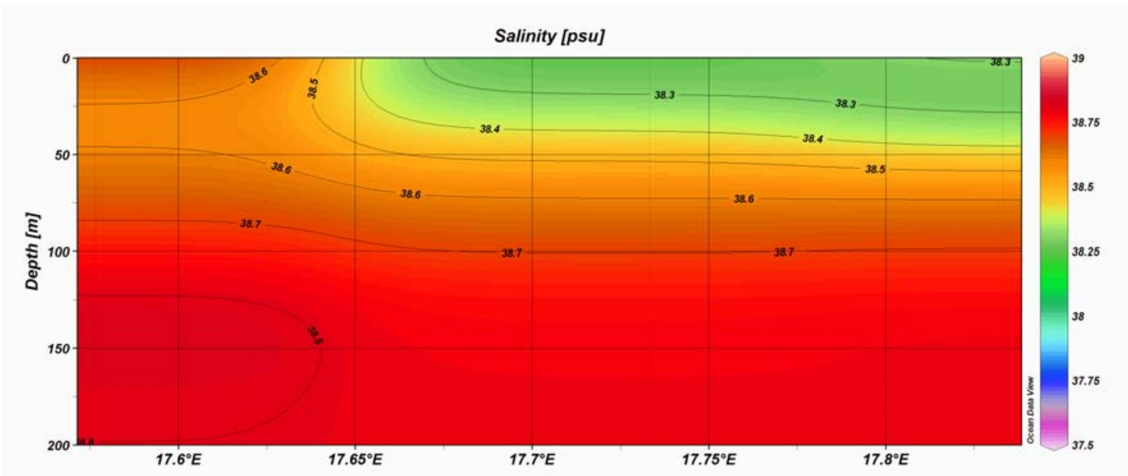


Figure 27. Salinity profile of transect G.

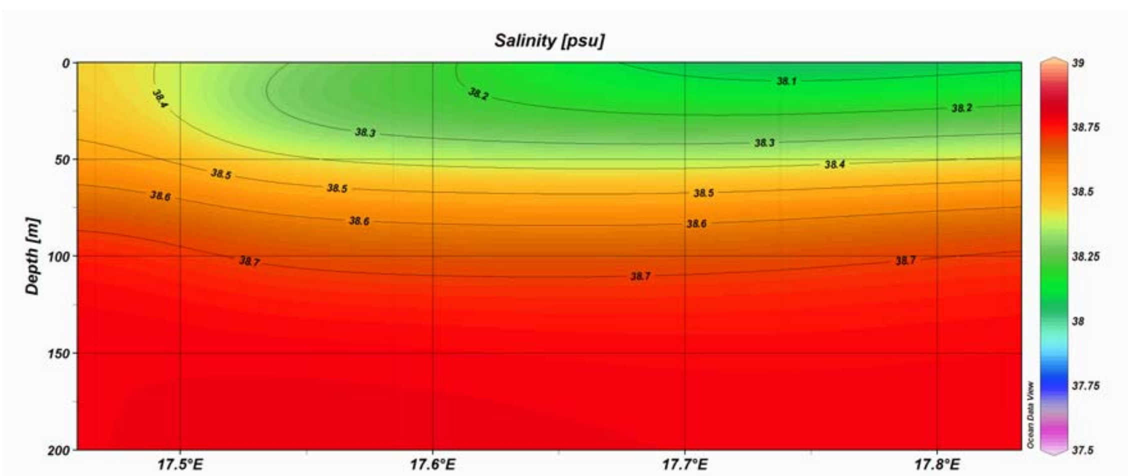


Figure 28. Salinity profile of transect H.

3.3 Sediment sampling

Kay Emeis and Gerhard Schmiedl

Gravity cores (inner Ø 12 cm, liner Ø 11 cm) weighted with 480 kg of lead and 3 to 6 m long were taken at all sediment stations. Recovery was between 2.2 and 5.6 meters. The plastic liners were cut into sections 100 cm long, capped and sealed with electric tape. Each of the sections was labelled with cruise number, station number, core, section (section 1 being the lowermost), and up/down, as well as with the section interval from the sediment-water interface. All cores were stored at 4°C for shorebased description and logging. At some stations, the gravity corer was used foil-mode, with an 8-m-long inner lining of PE foil inside the plastic liner. Upon recovery, the foil was pulled out and cut lengthwise to examine the recovered sediment sections. The preliminary lithology of the sediments retrieved by gravity coring is based on visual description. Colours have been identified according to the MUNSELL soil colour chart. These foil cores were discarded.
Multicores were collected at all stations (Table 2.). For dinoflagellate cyst and benthic foraminiferal investigations the upper cm of the cores were collected and stored at 4°C for further analyses. From every station one core has immediately been frozen at -40°C to be stored successively at -20°C until further treatment. The remaining cores were sliced in 1-cm-slices. The slices were sealed in PE foil and stored at 4°C.

The visual lightness and colour of surface sediment samples (0-1 cm) from the multicorer deployments were determined using a hand-held Minolta Series 532 Colour Spectrophotometer. The instrument measures spectral reflectance in the range from 400nm to 700nm at steps of 20 nm. Table 3. lists the results for each of the sediment samples. In the table, L* denotes Lightness (0= Black; 100=White), a* is a measure of the green-red value (-60=green; +60=red), b* is a measure of the blue-yellow value (-60= blue, + 60= yellow).

Figure 29. Gravety core (left), core sediment collected with foil (right).

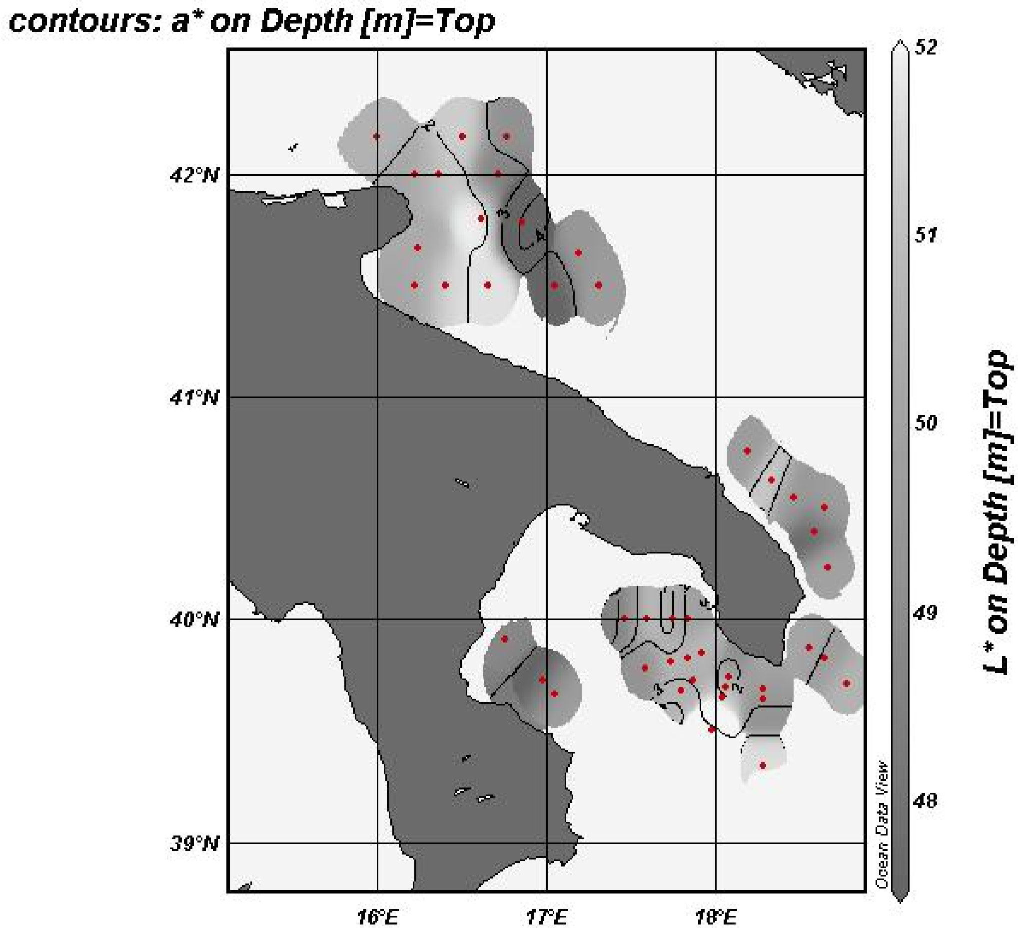
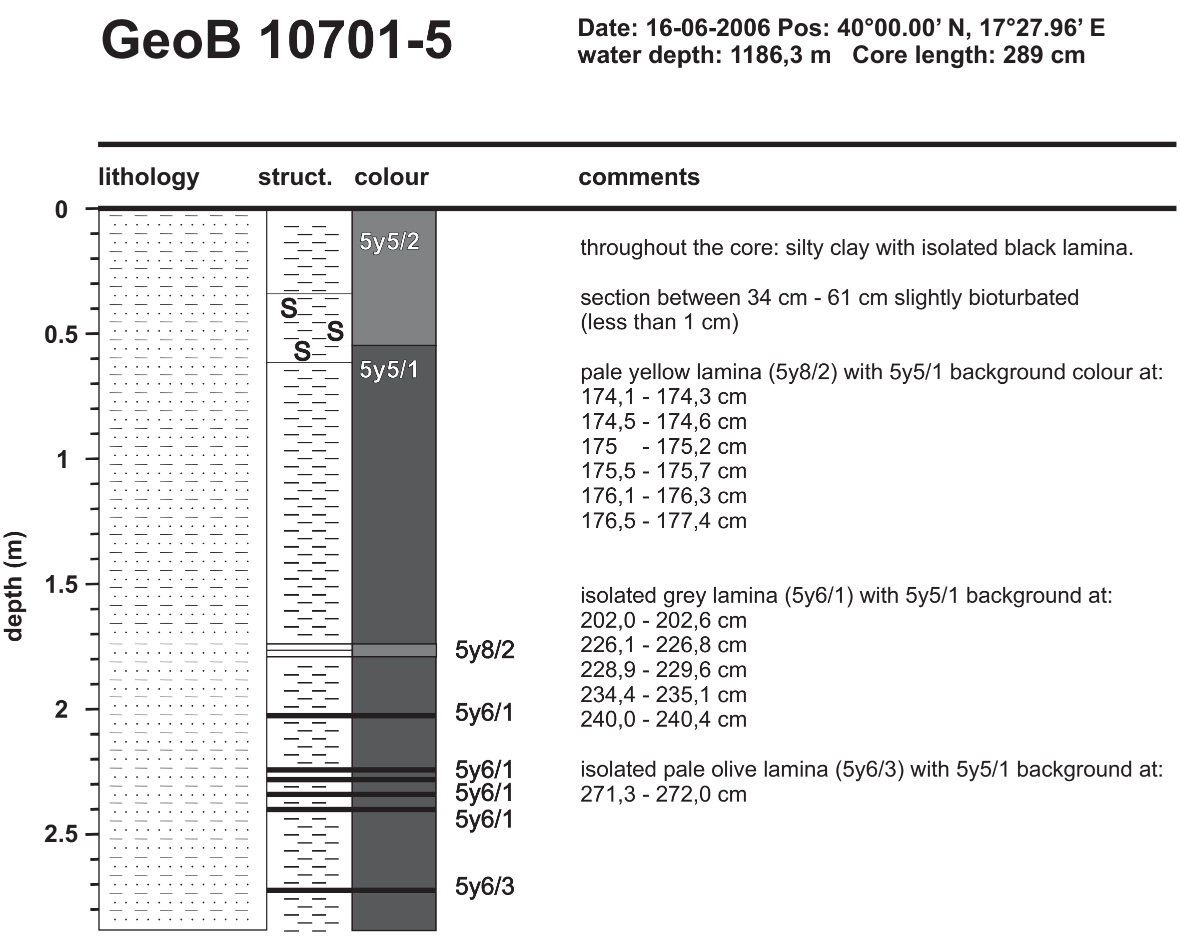


Figure 30. Map depicting the regional sediment lightness L* on a grey scale superimposed With isolines of a*.

3.3.1 Core descriptions

Karin zonneveld

Core descriptions have been established onshore and are depicted in Figures 31 – 43.



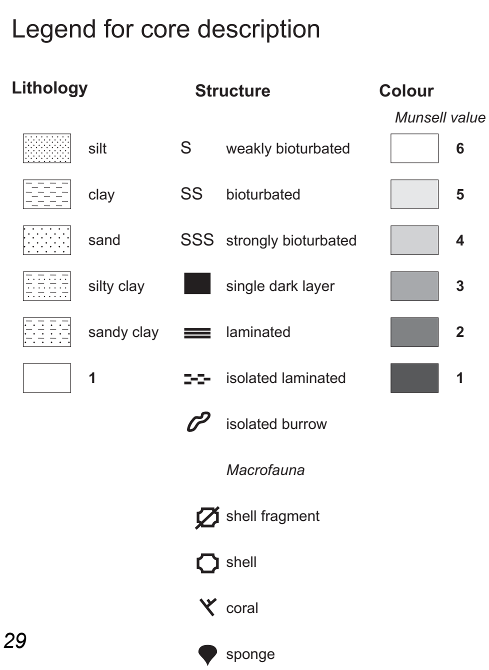
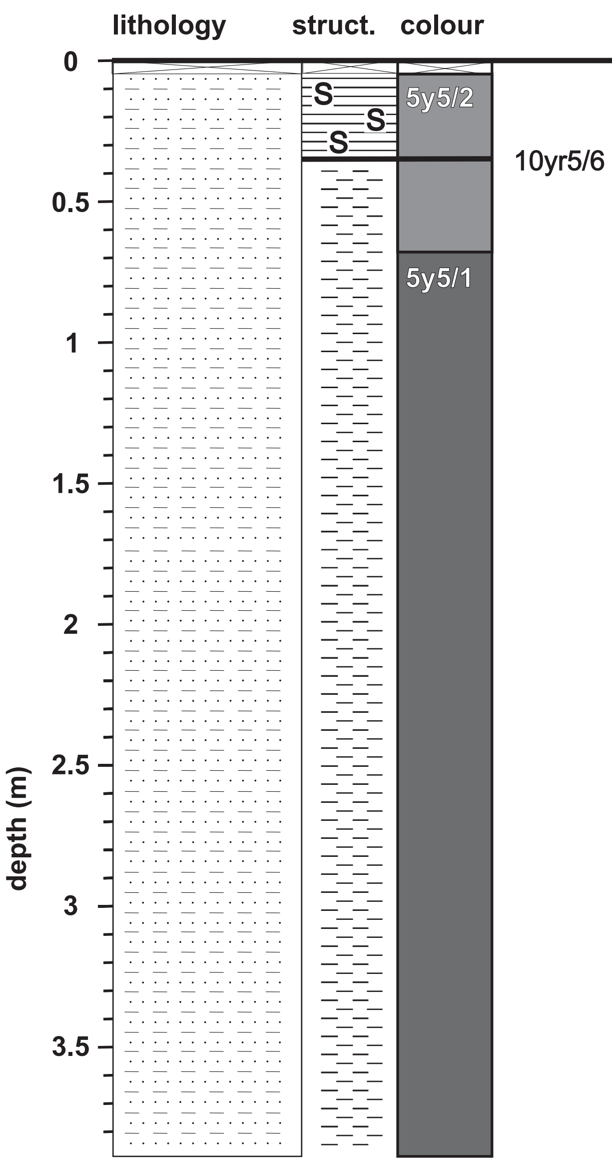


Figure 31.

GeoB 10703-5

Date: 16-06-2006 Pos: 40°00.00’ N, 17°44.52’ E
water depth: 277,3 m Core length: 389 cm



comments

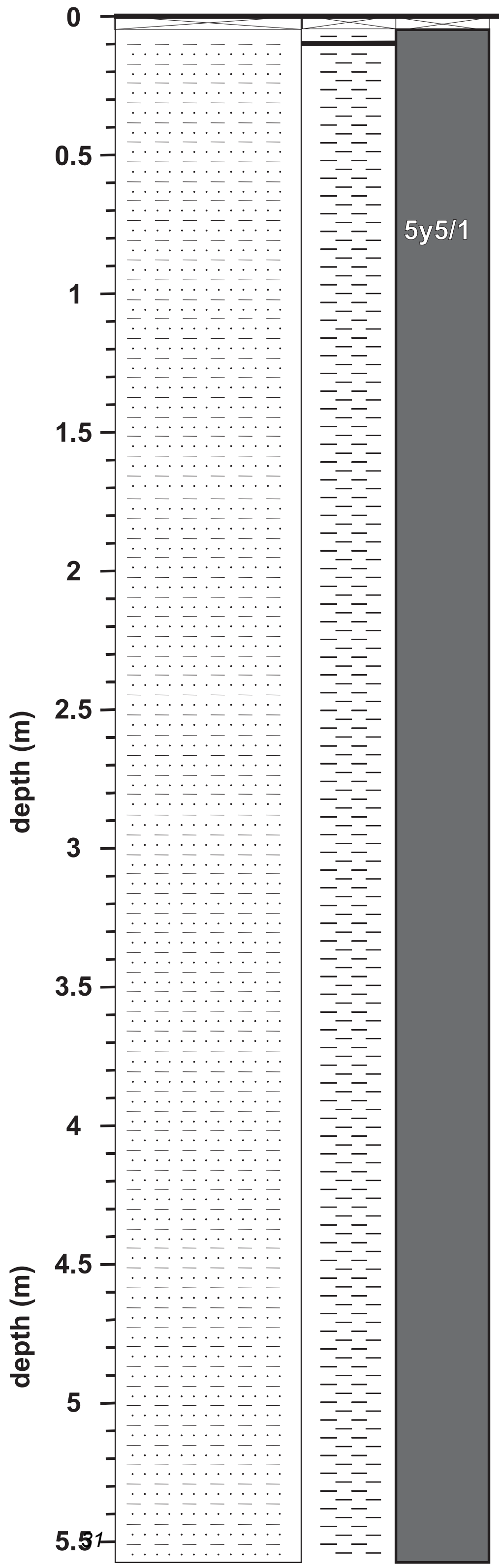
throughout the core: silty clay with isolated black lamina.

section between 3.5 cm - 34.8 cm laminated sediments with slight bioturbation (less than 1 cm)

yellow brown lamina (10yR5/6) at:
34,8 - 35,2 cm

GeoB 10704-5

Date: 19-06-2006 Pos: 39°59.99' N, 17°49.99' E
water depth: 219,3 m   Core length: 558 cm



comments

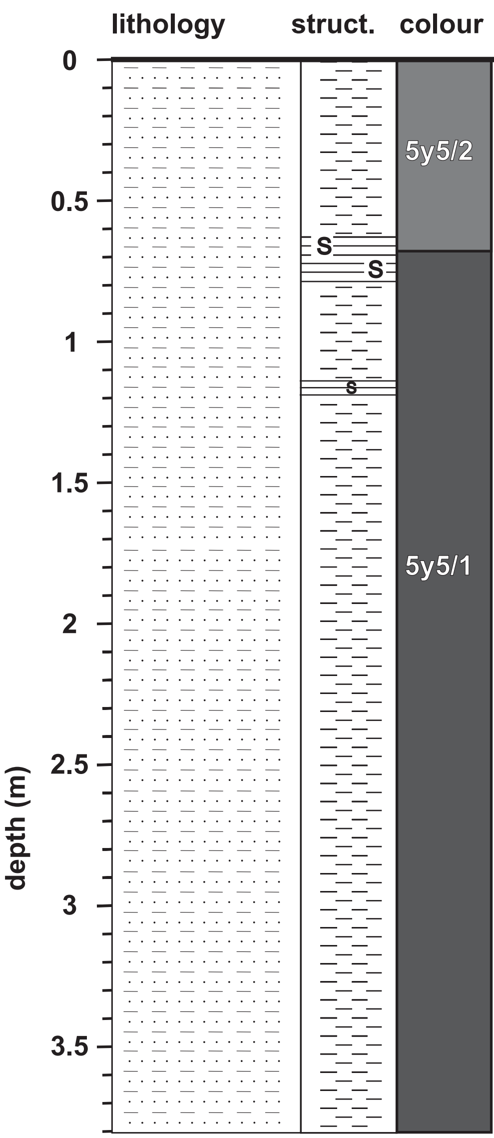
throughout the core: silty clay with isolated black lamina.

black lamina at:
9.1 - 9.4 cm

GeoB 10706-4

Date: 19-06-2006 Pos: 39°49.50' N, 17°50.00' E
water depth: 218,3 m   Core length: 388 cm

comments

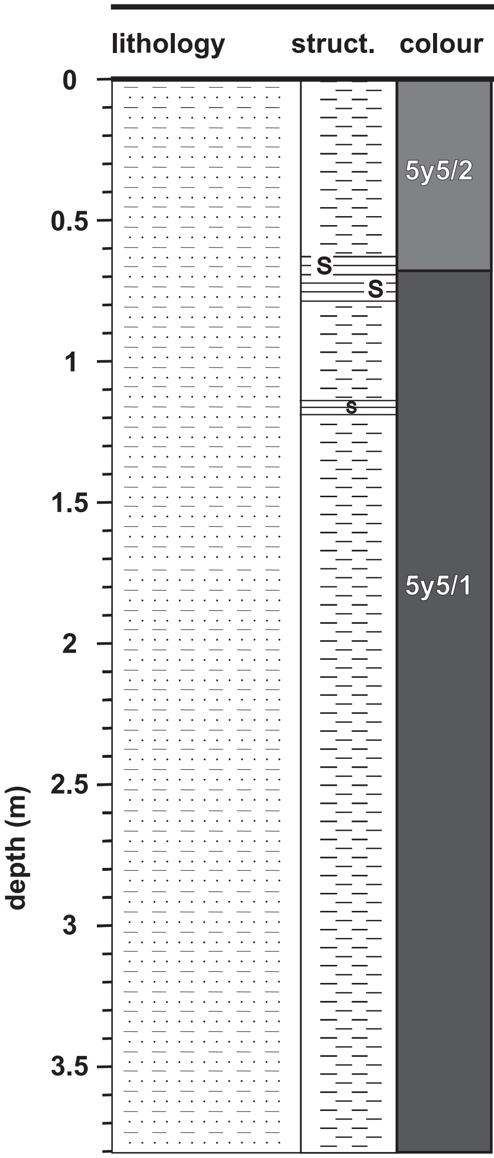


throughout the core: silty clay with isolated black lamina.

Slight bioturbation between 64 - 79 cm and 113 and 119 cm.
Bioturbation less than 1/2 cm

GeoB 10706-4

Date: 19-06-2006 Pos: 39°49.50' N, 17°50.00' E
water depth: 218,3 m   Core length: 388 cm

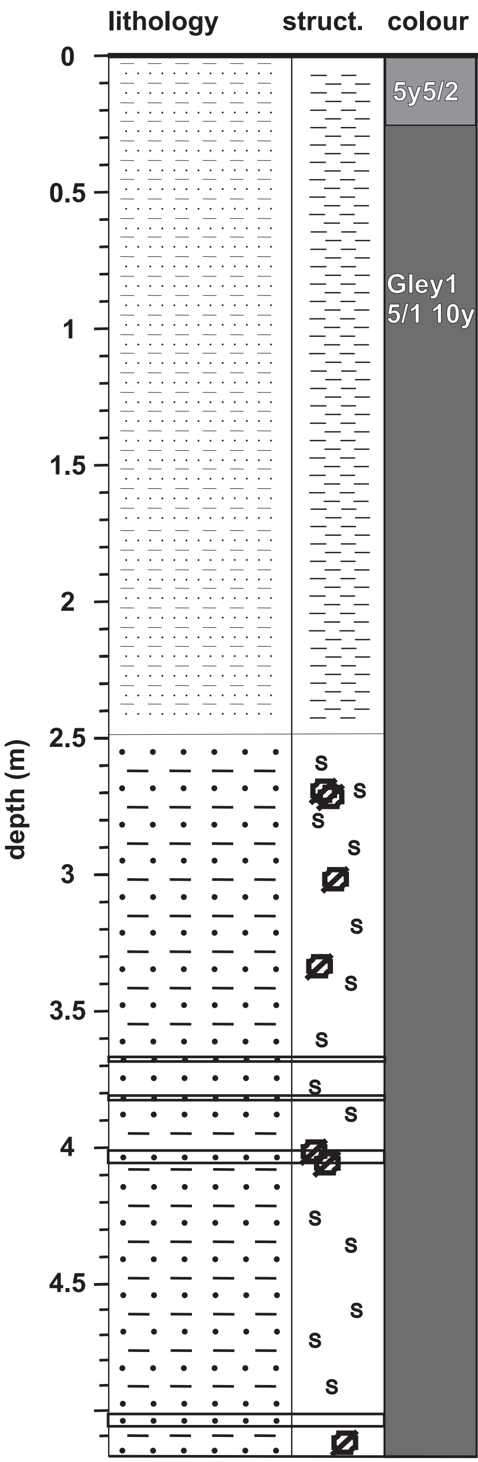


throughout the core: silty clay with isolated black lamina.

Slight bioturbation between 64 - 79 cm and 113 and 119 cm.
Bioturbation less than 1/2 cm

GeoB 10709-6

Date: 20-06-2006 Pos: 39°45.407' N, 17°53.57' E
water depth: 173,3 m   Core length: 518 cm



comments

0 - 249 cm silty clay with isolated black lamina.
No sighns of bioturbation
153 - 160 cm bioturbation up to 2 cm
194 - 198 cm bioturbation up to 2 cm

226 - 230 cm black lense
233 - 236.5 cm black lense

249 - 514 cm sandy clay with shell fragments. Sand particles are foraminifera and shell fragments.
Bioturbation up to 2 cm.

269 - 269.5: shell fragment
270.5 - 271.5: mollusc
305.5 - 308.5: large shell
338.1 - 339.6: shell fragment
401.5 - 402.5: shell fragment
405.5 - 406: shell fragment
514: shell fragment

367.5 - 369.5 cm sandy lense

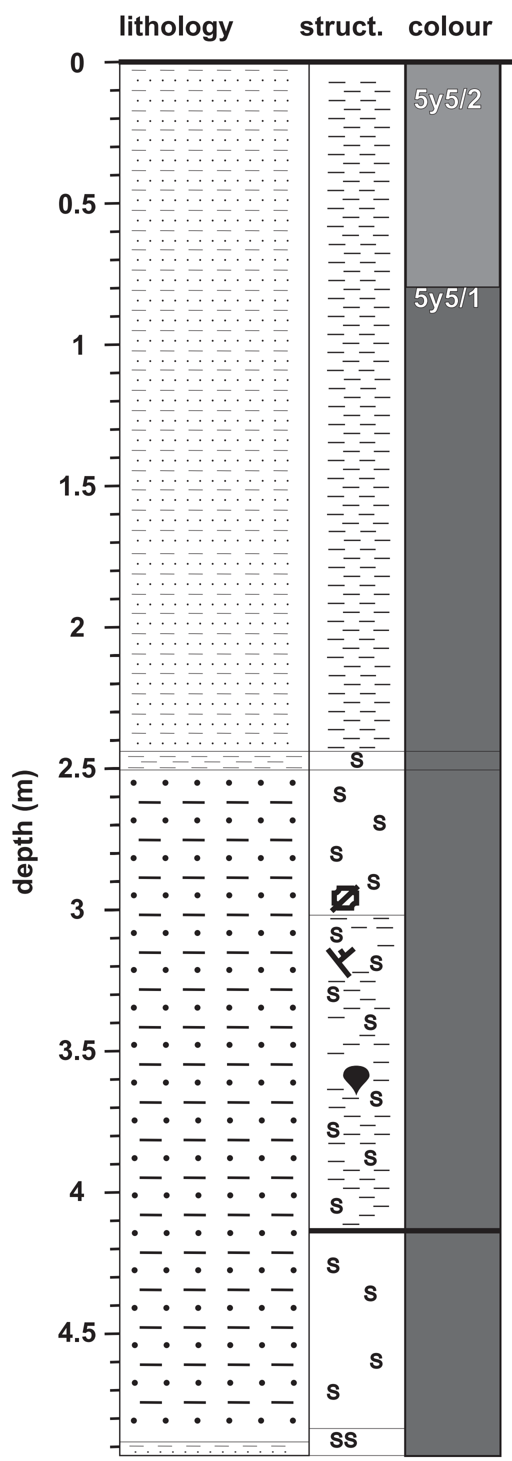
382.5 - 384.5 cm sandy lense

401 - 407 cm sand with shell fragments

503 - 506 cm sandy lense

GeoB 10709-8

Date: 20-06-2006 Pos: 39°45.43' N, 17°53.54' E
water depth: 173,3 m   Core length: 492 cm



comments

0 - 192 cm silty clay with isolated black lamina.
No sighns of bioturbation

192 - 246 cm silty clay with isolated black lamina and black particles

246 - 250 cm clay with slight bioturbation (less than 1,5 cm)

250 - 292 cm gradual change from clay with minor sand fraction to sandy clay.
Sand particles are foraminifera.
Bioturbation up to max. 2 cm.

292 - 301.5 cm sandy clay. Sand particles are foraminifera.

301.5 - 392 cm Sandy clay. Sand fractions consist of shell fragments and foraminifera.

299, 8 - 300,4 cm: large shell fragment
316,8 - 318,4 cm: Coral
357,3 - 357,6 cm: sponge fragment

392 - 398,4 cm sandy clay with isolated black lamina.
Slightly bioturbated (max. 2 cm)
Sand particles are foraminifera.

398,4 - 413 cm clay with small sand fraction, isolated black particles.
Slightly bioturbated (max. 1,5 cm)
Sand particles are foraminifera.

413 - 413,5 cm black lamina

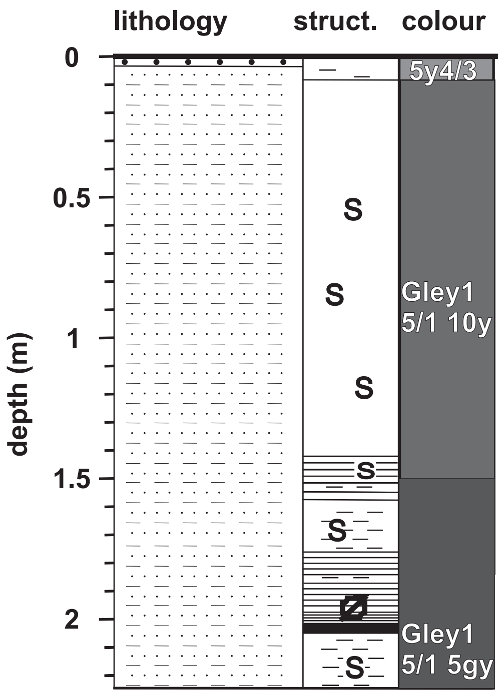
413,5 - 489 cm silty clay with small sand fraction

489 - 490,2 cm silty clay

485 - 489 cm bioturbated (up to 4 cm).

GeoB 10729-6

Date: 26-06-2006 Pos: 41°38.764' N, 17°11.5505' E
water depth: 711.3 m Core length: 225 cm



comments

0 - 2 cm sand
2 - 225 cm silty clay with isolated sand particles
sand particles consist of foraminifera

3.7 - 5.2 cm sand lens
5.4 - 6.0 cm sand lens

25 - 41 cm gradualy increase in bioturbation

88.3 - 89.3 cm pyrite nodule

125 - 225 cm isolated black laminae

141 - 151 cm black laminae with a lens of bioturbation
153 - 153.3 cm black lamina
156 - 156.2 cm black lamina
177 - 184 cm black laminae
187.5 - 195 cm black laminae

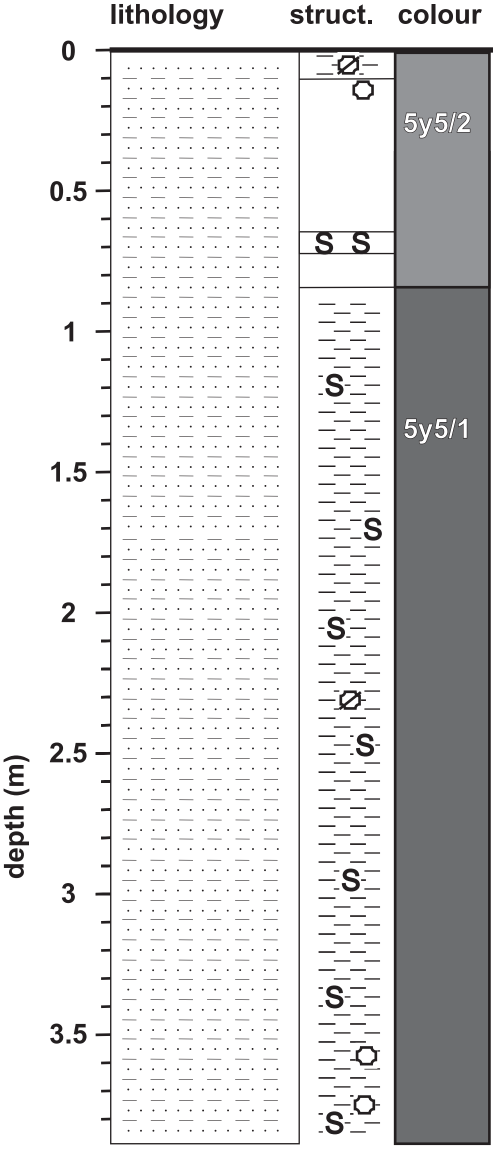
197 - 197.5 cm shell fragment

198.5 - 202.5 cm black laminae

202.5 - 205.5 cm extreme dark layer

GeoB 10731-5

Date: 27-06-2006 Pos: 41°29.994' N, 16°39.485' E
water depth: 97.3 m   Core length: 386 cm



comments

2.5 - 10.5 cm isolated black lamina.

13.5 - 15.5 cm Gastropod shell

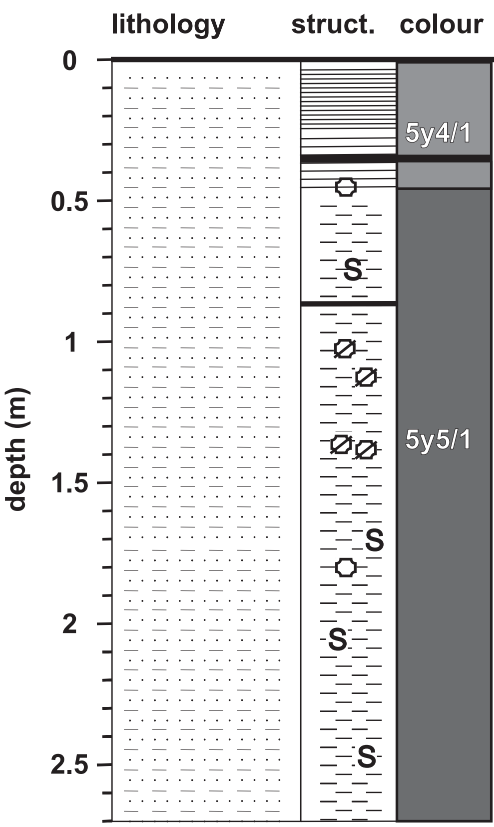
65 - 73 cm slight bioturbation

78.5 - 79 cm shell fragment
235 - 232.5 shell fragment
356 - 359 cm Gastropod shell
377.5 - 380.5 Gastropod shell

73 - 334 cm bioturbation up to 2 cm
334 - 354 cm slight bioturbation
354 - 385 cm bioturbation up to 2 cm

GeoB 10734-5

Date: 27-06-2006 Pos: 41°39.999' N, 16°14.482' E
water depth: 17.3 m   Core length: 270 cm



0 - 270 cm silty clay with isolated dark laminae

3 - 23.5 cm abundant black laminae
23.5 - 35 cm black laminae but less abundant
35 - 36 cm black layer
36 - 46.5 cm less abundant black laminae

46 - 48.5 cm Gastropod

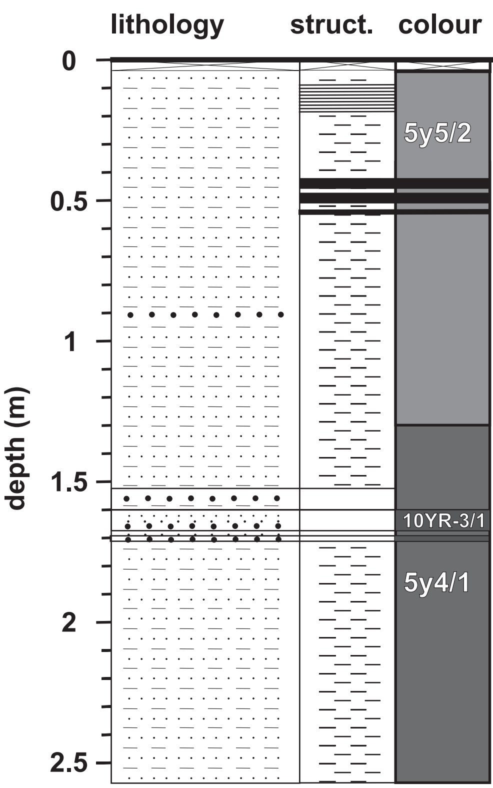
87 - 87.5 cm dark green layer

102.6 cm shell fragment
138.7 cm shell fragment
140.3 cm shell fragment
180 - 180.5 cm Geastropod

158 - 170.5 cm silty clay with foraminifera

GeoB 10735-4

Date: 28-06-2006 Pos: 41°29.999’ N, 17°18.506’ E
water depth: 734.3 m   Core length: 257 cm



comments

0 - 257 cm silty clay with isolated dark laminae
no sighns of bioturbation

9 - 13.8 cm abundant black laminae
13.8 - 14 cm black layer
18.5 - 19 cm black layer
43.5 - 47.5 cm black layer
48.5 - 50.5 cm black layer
53.4 - 53.8 cm black layer

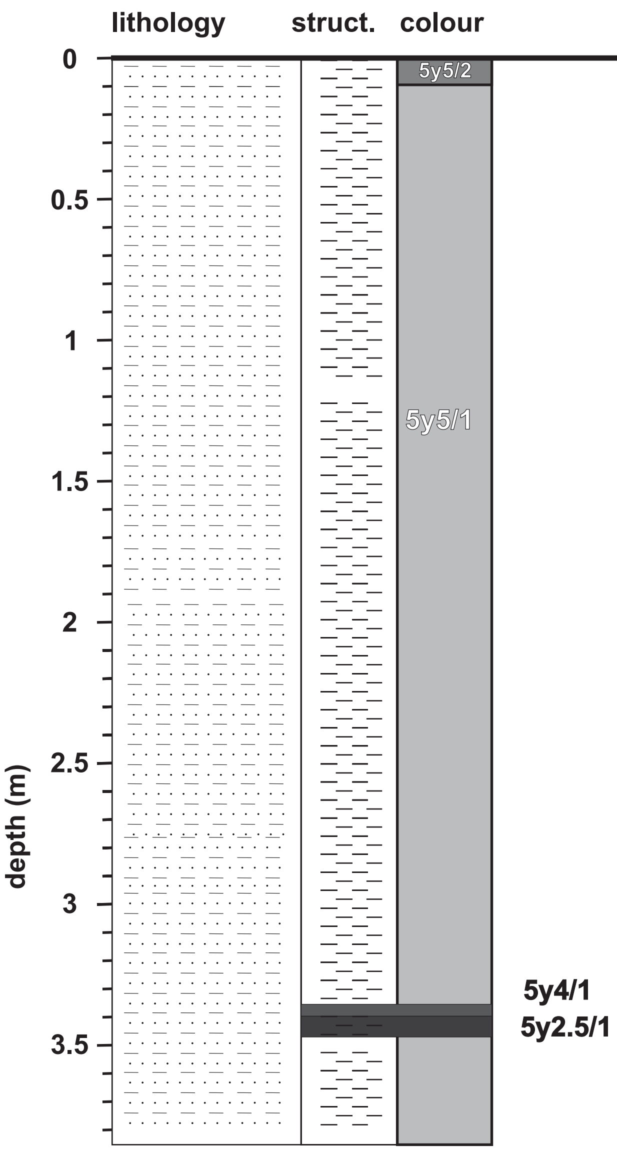
90.5 - 91.5 cm isolated pocket with more formaninifera

157 - 160.5 cm sandy clay
160.5 - 167.5 cm dark layer with fining upward

167.5 - 170.5 cm dark laminae

GeoB 10745-3

Date: 30-06-2006 Pos: 39°49.50' N, 17°43.98' E
water depth: 689,3 m   Core length: 385 cm

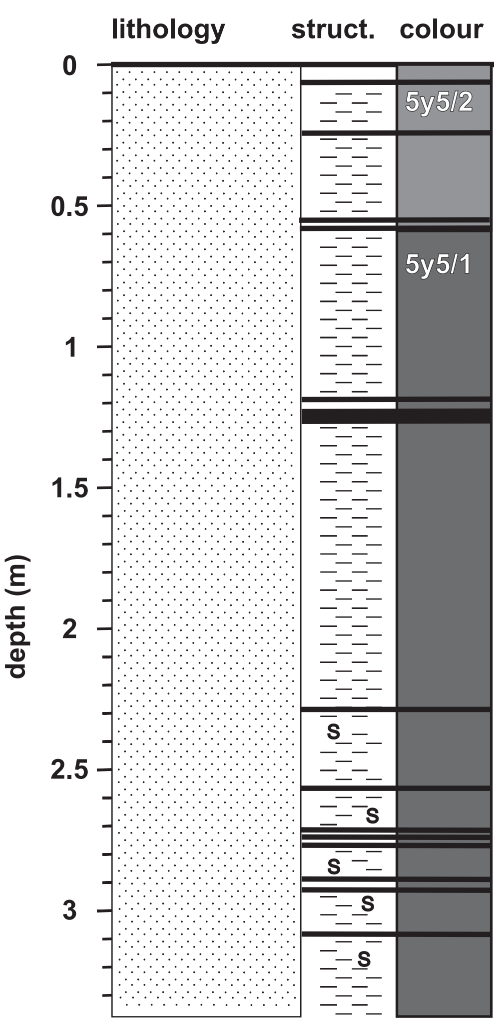


comments

throughout the core: silty clay with isolated black lamina and isolated black particles.
0 - 190 cm no sighn of bioturbation
190 - 346 cm slight bioturbation
346 - 378 cm moderate bioturbation
378 - 388 cm slight bioturbation.
0-1 cm light yellow brown (2.5Y6/3) silty clay

GeoB 10746-5

Date: 31-06-2006 Pos: 39°54.50' N, 16°45.51' E
water depth: 157,3 m   Core length: 338 cm



comments

throughout the core: silt with isolated black lamina.

gradual change from olive gray (5y5/2) to gray (5y5/1) between 35 - 70 cm.

Prominent black lamina at:
7,0 - 7,6 cm
24,2 - 24,8 cm
56,0 - 56,2 cm
59,0 - 60,4 cm
119,8 - 120,2 cm
121,5 - 124,0 cm
239,0 - 240,2 cm
257,5 - 258,2 cm
272,8 - 273,4 cm
274,9 - 275,5 cm
275,9 - 276,2 cm
289,8 - 290,2 cm
291,0 - 291,6 cm
309,4 - 310,6 cm

121 - 338 with slight bioturbation (less than 2 cm)

3.4 Distribution of Recent benthic foraminifera in the Gulf of Taranto

Gerhard Schmiedl and Tanja Kuhnt

3.3.1 Introduction

Deep-sea benthic foraminifera are strongly dependent on organic matter fluxes and inhabit a number of different stratified microhabitats on and below the sediment surface (e.g. Corliss 1985; Jorissen et al. 1995). In food-limited environments, such as most parts of the eastern Mediterranean Sea, that are commonly characterized by oxic conditions, both foraminiferal standing stock and diversity are rather low and the fauna mainly comprises epifaunal species. In mesotrophic environments, standing stocks are moderately high and faunal diversity is at a maximum. The corresponding assemblages comprise a variety of epifaunal, shallow infaunal and deep infaunal species. In the Mediterranean Sea, such faunas are commonly restricted to shelf and upper bathyal ecosystems in near-coastal areas where river-derived nutrient fluxes result in elevated productivity and organic matter fluxes (e.g. De Rijk et al. 2000; Schmiedl et al. 2000). Finally, in an eutrophic and oxygen-limited environment, a low-diversity fauna with high standing stock prevails, mainly comprising intermediate and deep-infaunal species that are adapted to dysoxic conditions (e.g. Jorissen et al. 1995).

Today, the water masses of the Mediterranean Sea are well oxygenated. As a consequence, benthic ecosystems are predominantly controlled by the quantity and quality of organic matter availability. Major aim of the present study is to map the impact of surface water productivity and organic matter fluxes induced by Po river discharge on the benthic ecosystems along the southwest Adriatic coast and in the Gulf of Taranto. The recent distribution patterns and stable isotope signatures of benthic foraminifers will serve as reference data set for the evaluation of abrupt productivity changes and fluctuations in Po discharge during the late Holocene.

3.3.2 Material and Methods

A multicorer was used to recover undisturbed samples from near-surface sediments, in particular from the uppermost sediment centimeters and the overlying bottom water. The multicorer was equipped with 10 tubes, each of it 60 cm long (6 with an inner diameter of 95 mm and 4 with an inner diameter of 60 mm). The multicorer was run in the water column with descendence and ascendence velocities of 0.5 to 1.0 m/s, near the sea floor with a reduced velocity between 0.2 and 0.5 m/s. The total lead weight of the multicorer was modified according to the consistency of the sediments. A total of 49 different sites have been sampled for benthic foraminifers (Tab. 2). At 22 stations the uppermost 10 cm of the surface sediment of a 95 mm tube have been cut into slices of 0.5 cm (for the uppermost cm) and

1 cm (below 1 cm depth), at all other stations the 0-5 cm sediment interval of a 60 mm tube has been sampled. Subsequently, all samples have been preserved with Rose Bengal stained ethanol.

For an on-board assessment of the Recent foraminiferal distribution patterns, surface sediments from transects 1 through 4 of the eastern Gulf of Taranto have been studied. From the >63 µm fraction, approximately 100 benthic foraminiferal specimens (living individuals and empty tests) were counted and evaluated for their microhabitat preferences. In addition, the proportion of planktic foraminifers on the total foraminiferal fauna (expressed as PF/(PF+BF) ratio, with PF = planktic foraminifers and BF = benthic foraminifers) has been determined.

3.3.3 Results and Discussion

The ratio between planktic and benthic foraminifers in the eastern Gulf of Taranto shows an increase of values with increasing distance from the coast (Fig. 41a). This pattern is in general accordance with observations from other oceans documenting an increase of the planktic/benthic ratio with increasing water depth (Gibson, 1989). Particularly low numbers of planktic foraminifers are observed along the two northernmost transects (transect 1 and 2), even at lower bathyal water depths. This points to highly variable surface water conditions in this region. Obviously, strong seasonal fluctuations in temperature, salinity and nutrients prevented the development of stable open-ocean planktic assemblages.

The diversity and microhabitat structure of benthic foraminifers in the eastern Gulf of Taranto reveal significant spatial patterns that can be related to gradients in organic matter fluxes, substrate, and oxygen penetration in the surface sediment. At the northern sites (transects 1 and 2), surface sediments contain extremely high numbers of benthic foraminifers. The faunas of these sites are characterized by moderate to high diversity and a dominance of rotaliid taxa. Shallow to deep infaunal taxa are dominant while epifaunal taxa are of lower abundance. According to the TROX model of Jorissen et al. (1995), these faunas represent mesotrophic to eutrophic ecosystems with a moderate oxygen penetration into the sediment. As characteristic representatives of these faunas, the distribution of *Bolivina* spp. and *Brizalina* spp. is shown in Fig. 1b. At several stations of the shelf and upper bathyal sites of transects 1 and 2, the relative abundance of these genera exceeds 20 % of the total benthic foraminifers. The abundance maxima of these taxa correlate with a rather thin oxidized („brown“) layer of ≤ 5 cm and the presence of fine-grained and water-rich sediments. Various authors have shown that the genera *Bolivina* and *Brizalina* are part of the shallow to intermediate infauna and typically occur in high productivity areas, often combined with oxygen-depleted environments or microhabitats (Sen Gupta and Machain-Castillo, 1993; Ohga and Kitazato, 1997). In the Mediterranean region, these genera are particularly abundant in eutrophic and suboxic environments of the Marmara Sea (Alavi, 1988). In addition, these taxa can be abundant close to and even within Quaternary sapropel layers demonstrating their tolerance with respect to low-oxygen conditions (Jorissen, 1999; Schmiedl et al., 2003). In contrast to the northern transects, the sites in further distance to the embayment of the Gulf (e.g., bathyal sites of transects 3 and 4) exhibit a rather low-diverse fauna which is characterized by epifaunal and shallow infaunal taxa, such as *Cibicidoides pachydermus, Planulina ariminensis, Uvigerina peregrina*, and by various agglutinating and miliolid taxa. This fauna documents the transition to the more oligotrophic settings of the deeper basins of the eastern Mediterranean Sea (De Rijk et al., 2000).

3.3.4 Summary

The foraminiferal faunas of the eastern Gulf of Taranto likely mirror the influence of nutrient-rich Po discharge water that causes elevated surface water productivity and high organic matter fluxes to the sea floor. Typical bathyal faunal elements are found also on the middle to outer shelf which is likely caused by the presence of fine-grained organic-rich muds even at rather shallow water depth. Our preliminary data predict that any climatically or anthropogenically driven changes in Po discharge of the past should have been recorded in the foraminiferal fauna of the sediment cores of this region.

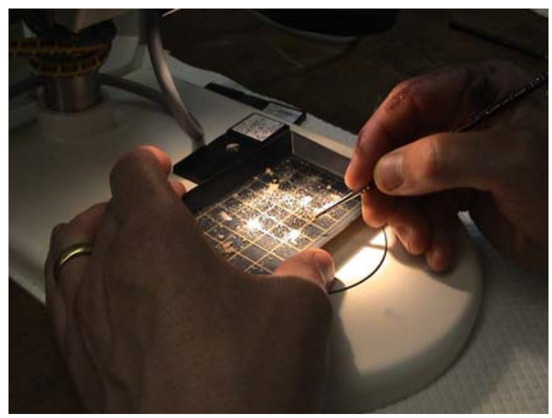
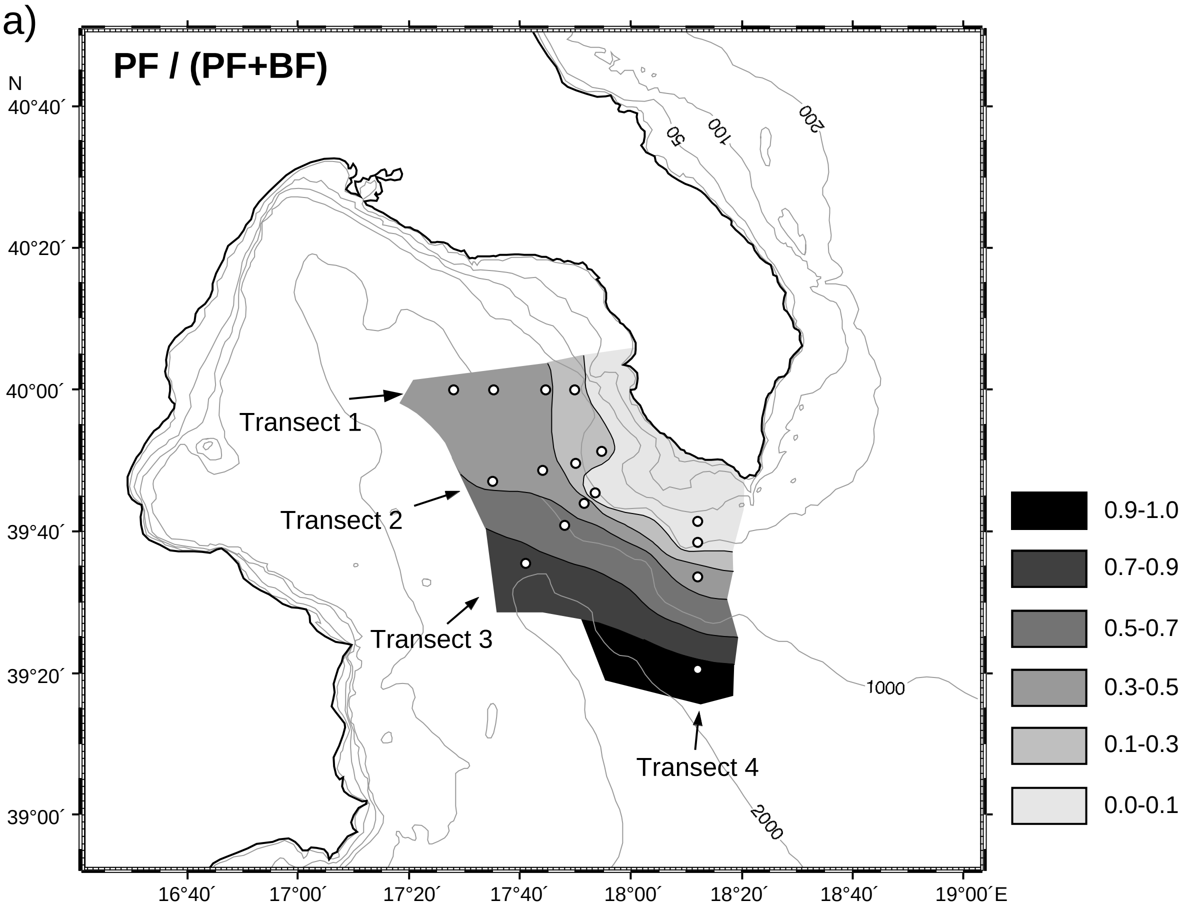
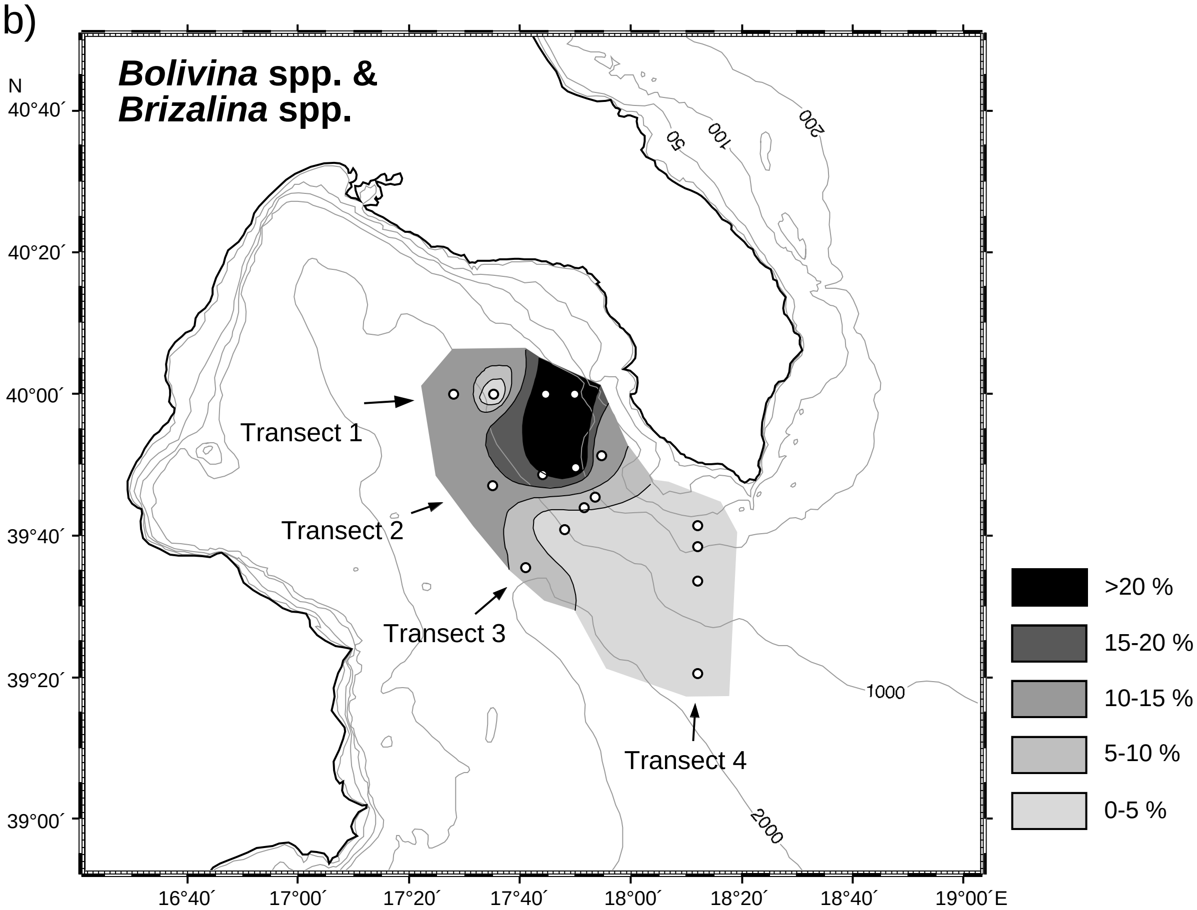


Figure 45. Collecting (left) and analysing (right) benthic foraminifera.

a)


PF / (PF+BF)
N
40°40´
40°20´
40°00´
39°40´
39°20´
39°00´
16°40´
17°00´
17°20´
17°40´
18°00´
18°20´
18°40´
19°00´E
50
100
200
1000
2000
Transect 1
Transect 2
Transect 3
Transect 4
0.9-1.0
0.7-0.9
0.5-0.7
0.3-0.5
0.1-0.3
0.0-0.1

b)


Bolivina spp. &
Brizalina spp.
N
40°40´
40°20´
40°00´
39°40´
39°20´
39°00´
16°40´
17°00´
17°20´
17°40´
18°00´
18°20´
18°40´
19°00´E
50
100
200
1000
2000
Transect 1
Transect 2
Transect 3
Transect 4
>20 %
15-20 %
10-15 %
5-10 %
0-5 %

3.5 Chemistry

Shauna Ní Fhlaithearta

3.5.1 Introduction

Porewater has been extracted at seven stations and subsequently sub-sampled for the measurement of alkalinity, DIC, $\delta^{13}C$ of DIC and major and minor elements (see table 1). Alkalinity values were measured onboard while the rest of the samples were stored for analysis at the home laboratory.

Cores, suspended sediment and surface sediments were also recovered from several sites (see table 2-4). They will undergo an array of geochemical analysis at the home laboratory.

3.5.2 Methods

Porewater

A predrilled multicore liner (series of 3mm diameter holes with a 10mm vertical spacing) is mounted onto the multicore. After recovery the porewater is extracted using Rhizons (8cm polymer tube, pore diameter 0.1um, tip diameter 2.5m, female luer, glassfibre-epoxy strengthener). The Rhizons are attached to a 10ml syringe via a 3-way valve. Once inserted the syringe plunger is pulled to maximum extension and secured with a buttress. This creates a vacuum which pulls porewater from the sediment, through the polymer tube and into the syringe. Once a sufficient sample volume is extracted the 3-way valve is closed until the sample is ready to be distributed amongst various sub-sample vials.

Alkalinity titrations have been performed onboard using the titrimetric alkalinity method. The sample is titrated with a strong acid, followed by plotting the points of the titration curve on a Gran-plot. We used 0.01M HCL to determine alkalinity in this way.

DIC and $\delta^{13}C$ of DIC samples are poured into (air tight) glass vials until full and stored at 4°C. Samples for major and minor elements are kept in 8ml Nalgene™ bottles, acidified and stored at 4°C.

Cores

Cores are recovered using a multicorer. The remaining bottom water is removed after which the core is carefully sealed and stored upright at 4°C.

Suspended Matter

A volume of approximately 10 litres is filtered over a 5µm polycarbonate filter using a vacuum filtration system. The filter is then dried at 30°C in the oven and stored in a petridish.

Surface sediments

The top 2mm of surface sediments are placed in a glass vial and stored at 4°C.

3.5.2 Results and discussion

Porewater

Site location	Sample interval depths (cm)
GEOB107-01-04	1, 2, 3, 5, 8, 12, 16, 22, 29, 36
GEOB107-03-03	1, 2, 3, 5, 8, 12, 16, 22, 29, 36, 48
GEOB107-09-02	1, 2, 3, 5, 8, 12, 16, 22
GEOB107-12-03	1, 2, 3, 5, 8, 12, 16, 22, 29, 36
GEOB107-31-03	1, 2, 3, 5, 8, 12, 16, 22, 29, 36, 44
GEOB107-35-03	1, 2, 3, 5, 8, 12, 16, 22, , 29, 36, 47
GEOB107-46-04	1, 2, 3, 5, 8, 12, 16, 22, 29, 36, 48

Table 3.5.1 Site locations and sample interval depths

A porewater profile from site GEOB107-46-04 is shown in Fig.46. Alkalinity increases linearly with depth from 2.6 to 5.9 mM. The trend of an increasing alkalinity with depth is common in sediments found in this area.

In general, changes in alkalinity are associated with changes in salinity or biogeochemical processes such as organic matter degradation and associated carbonate dissolution.

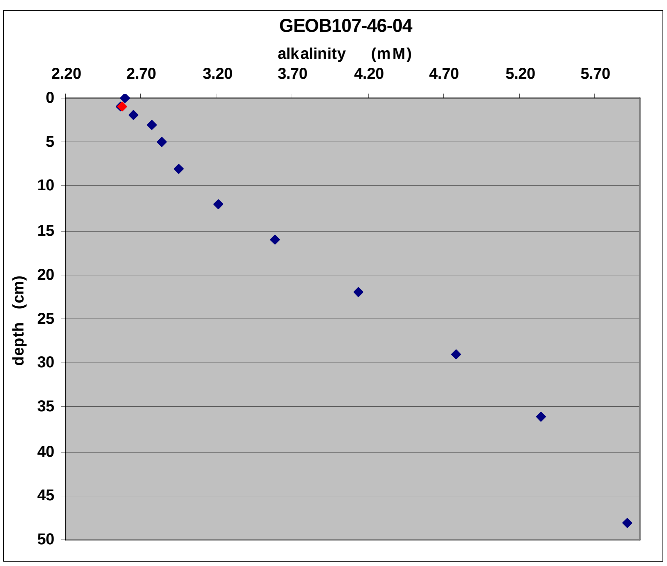


Figure 46. Alkalinity profile for station GEOB107-46-04

Cores, suspended matter and surface sediments

Table 3.5.2, 3.5.3 & 3.5.4 below list the stations where cores, suspended matter and surface sediments have been recovered.

Cores

Site location
GEOB107-17
GEOB107-18
GEOB107-19
GEOB107-20
GEOB107-25
GEOB107-39

Table 2

.

Suspended Matter

Site location	Depth in water column (m)
GEOB107-13	5
GEOB107-15	5
GEOB107-17	70
GEOB107-18	180
GEOB107-19	180
GEOB107-20	180
GEOB107-21	150
GEOB107-22	70
GEOB107-26	120
GEOB107-28	120
GEOB107-29	180
GEOB107-30	120
GEOB107-31	60
GEOB107-39	200
GEOB107-42	200
GEOB107-43	70
GEOB107-47	120
GEOB107-48	120

Table 3

Surface sediments

Site location
GEOB107-12
GEOB107-13
GEOB107-14
GEOB107-15
GEOB107-21
GEOB107-22
GEOB107-23
GEOB107-24
GEOB107-26
GEOB107-27
GEOB107-28
GEOB107-29
GEOB107-30
GEOB107-33
GEOB107-35
GEOB107-38
GEOB107-39
GEOB107-41
GEOB107-42
GEOB107-43
GEOB107-44
GEOB107-47
GEOB107-48

Table 4

4. References

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Table 1. Station overview

GeoB number	ship number	date	device	Lattitude (N)		Longitude (E)		start UTC	end UTC	UTC bottom contact	local time UTC +	water depth (m)	core length (cm)
GeoB 10701	666	18/06/2006		40°	00.00'	017°	27.98'	02:51			3	1182	
GeoB 10701-1		18/06/2006	CTD/Rosette	40°	0.01'	017°	27.94'	02:57	03:59		3	1183	
GeoB 10701-2		18/06/2006	Planktonnet	40°	0.01'	017°	27.94'	04:01	04:15		3	10	
GeoB 10701-3		18/06/2006	CTD/Rosette	39°	59.98'	017°	27.99'	04:26	04:37		3	46	
GeoB 10701-4		18/06/2006	MUC	40°	0.00'	017°	28.01'	04:57	05:53	04:25	3	1187	
GeoB 10701-5		18/06/2006	SL	40°	0.01'	017°	27.99'	06:11	06:46	05:11	3	1181	289
GeoB 10702	667	18/06/2006		40°	00.01'	017°	35.11'	08:30			3	909	
GeoB 10702-1		18/06/2006	CTD/Rosette	40°	0.09'	017°	35.13'	08:33	09:22		3	929	
GeoB 10702-2		18/06/2006	Planktonnet	40°	0.02'	017°	35.14'	08:45	08:55		3	929	
GeoB 10702-3		18/06/2006	MUC	40°	00.01'	017°	35:15'	09:26	10:07	09:50	3	910	
GeoB 10703	668	18/06/2006		39°	59.99'	017°	44.47'	11:44			3	277.3	
GeoB 10703-1		18/06/2006	CTD/Rosette	39°	59.99'	017°	44.47'	11.45	12:05		3		
GeoB 10703-2		18/06/2006	Planktonnet	39°	59.98'	017°	44.46'	11.57	12:10		3	10.0	
GeoB 10703-3		18/06/2006	MUC	39°	59.99'	017°	44.48'	12:09	12:30	12:23	3	277.3	
GeoB 10703-4		18/06/2006	MUC	39°	59.98'	017°	44.49'	12:51	13:14	13:04	3	277.3	
GeoB 10703-5		18/06/2006	SL	40°	00.00'	017°	44.52'	13:30	13:47	13.37	3	277.3	389
transect 3	669	18/06/2006	wp#2.7	39°	34.50'	17°	40.00'	18:52					
		19/06/2006	wp#2.8	39°	50.00'	17°	59.00'	01:22					
		19/06/2006	wp#2.9	40°	00.00'	17°	50.00'		04:26				
GeoB 10704	670	19/06/2006		39°	59.99'	017°	49.96'	04:46			2	219.3	
GeoB 10704-1		19/06/2006	CTD/Rosette	39°	59.97'	017°	49.99'	04:47	05:05		2		
GeoB 10704-2		19/06/2006	Planktonnet	39°	59.98'	017°	49.99'	05:13	05:31		2	10.0	
GeoB 10704-3		19/06/2006	MUC	40°	00.00'	017°	49.98'	05:32	05:55	05:47	2	219.3	
GeoB 10704-4		19/06/2006	SL	39°	59.98'	017°	49.99'	06:04		06:17	2	219.3	520
GeoB 10704-5		19/06/2006	SL	39°	59.99'	017°	49.99'	06:24		07:09	2	219.3	558
GeoB 10705	671	19/06/2006		39°	51.20'	017°	54.77'	09:12			2	128.3	
GeoB 10705-1		19/06/2006	CTD/Rosette	39°	51.20'	017°	54.75'	09:28	09:38		2		
GeoB 10705-2		19/06/2006	Planktonnet	39°	51.19'	017°	54.76'	09:30	09:40		2	10.0	
GeoB 10705-3		19/06/2006	MUC	39°	51.19'	017°	54.75'	09:43	09:56	09:50	2	128.3	
GeoB 10706	672	19/06/2006		39°	49.50'	017°	50.00'	11:06			2	218.3	
GeoB 10706-1		19/06/2006	CTD/Rosette	39°	49.50'	017°	50.00'	11:14	11:32		2		
GeoB 10706-2		19/06/2006	Planktonnet	39°	49.51'	017°	50.01'	11:20	11:30		2	10.0	
GeoB 10706-3		19/06/2006	MUC	39°	49.50'	017°	50.00'	11:35	11:53	11:48	2	218.3	
GeoB 10706-4		19/06/2006	SL	39°	49.50'	017°	50.00'	12:07	12:20	12:14	2	218.3	488
GeoB 10706-5		19/06/2006	SL	39°	49.50'	017°	50.00'	12:45	12:59	12:52	2	218.3	459
GeoB 10707	673	20/06/2006		39°	46.98'	017°	34.98'	02:31			2	1596.3	
GeoB 10707-1		20/06/2006	Planktonnet	39°	46.98'	017°	34.98'	02:32	02:52		2	10.0	
GeoB 10707-2		20/06/2006	CTD/Rosette	39°	46.99'	017°	34.99'	02:59	04:19		2		
GeoB 10707-3		20/06/2006	CTD/Rosette	39°	46.97'	017°	35.00'	04:30	04:46		2		
GeoB 10707-4		20/06/2006	MUC	39°	47.00'	017°	34.98'	04:49	05:52	05:30	2	1598.3	
GeoB 10708	674	20/06/2006		39°	48.49'	017°	44.02'	07:08			2	685.3	
GeoB 10708-1		20/06/2006	CTD/Rosette	39°	48.50'	017°	44.02'	07:14	07:53		2		0.805
GeoB 10708-2		20/06/2006	Planktonnet	39°	48.50'	017°	44.01'	07:18	07:41		2	10.0	
GeoB 10708-3		20/06/2006	MUC	39°	48.50'	017°	43.99'	08:00	8.25	08:12	2	686.3	
GeoB 10709	675	20/06/2006		39°	45.00'	017°	53.01'	10:12			2	220.3	
GeoB 10709-1		20/06/2006	CTD/Rosette	39°	45.00'	017°	53.02'	10:14	10:31		2		
GeoB 10709-2		20/06/2006	Planktonnet	39°	45.00'	017°	53.01'	10:15	10:37		2	10.0	
GeoB 10709-3		20/06/2006	CTD/Rosette	39°	45.40'	017°	53.57'	11:01	11:18		2		
GeoB 10709-4		20/06/2006	MUC	39°	45.41'	017°	53.56'	11:20	11:34	11:28	2	173.3	
GeoB 10709-5		20/06/2006	MUC	39°	45.39'	017°	53.57'	11:47	12:02	11:56	2	172.3	
GeoB 10709-6		20/06/2006	SL	39°	45.40'	017°	53.56'	12:11	12:25	12:19	2	172.3	518
GeoB 10709-7		20/06/2006	SL	39°	45.42'	017°	53.55'	12:45	12:59	12:52	2	172.3	486
GeoB 10709-8		20/06/2006	SL	39°	45.43'	017°	53.54'	13:16	13:29	13:23	2	173.3	492
GeoB 10710	676	21/06/2006		39°	35.51'	017°	40.98'	02:47			2	2040.3	
GeoB 10710-1		21/06/2006	CTD/Rosette	39°	35.52'	017°	40.97'	02:48	04:35		2		
GeoB 10710-2		21/06/2006	Planktonnet	39°	35.52'	017°	40.97'	02:48	03:24		2	10.0	
GeoB 10710-3		21/06/2006	CTD/Rosette	39°	35.51'	017°	41.02'	04:55	05:04		2		
GeoB 10710-4		21/06/2006	MUC	39°	35.49'	017°	41.00'	05:10	06:27	05:56	2	2040.3	
GeoB 10711	677	21/06/2006		39°	41.00'	017°	47.98'	07:48:00			2	1050.3	
GeoB 10711-1		21/06/2006	CTD/Rosette	39°	41.00'	017°	47.97'	07:49			2		
GeoB 10711-2		21/06/2006	Planktonnet	39°	41.00'	017°	47.98'	07:51	08:10		2	10.0	
GeoB 10711-3		21/06/2006	MUC	39°	41.00'	017°	48.00'	08:48	09:35	09:14	2	1049.3	
GeoB 10712	678	21/06/2006		39°	43.59'	017°	51.70'	11:18			2	620.3	

GeoB 10712-1		21/06/2006	CTD/Rosette	39°	43.60'	017°	51.67'	11:21	12:00		2	
GeoB 10712-2		21/06/2006	Planktonnet	39°	43.60'	017°	51.69'	11:23	11:50		2	10.0
GeoB 10712-3		21/06/2006	MUC	39°	43.59'	017°	51.69'	12:02	12:35	12:23	2	618.3
GeoB 10712-4		21/06/2006	SL	39°	43.58'	017°	51.68'	12:44	13:12	13:01	2	619.3
transect 5	679	21/06/2006	wp#3.1	39°	44.39'	18°	4.99'	16:45				
		21/06/2006	wp#3.2	39°	28.80'	17°	57.99'		20:02			
transect 4		21/06/2006	wp#3.3	39°	20.05'	18°	16.85'	23.14				
		22/06/2006	wp#3.4	39°	44.00'	18°	17.00'		03:03			
GeoB 10713	680	22/06/2006		39°	41.50'	018°	16.99'	03:57			2	127.3
GeoB 10713-1		22/06/2006	CTD/Rosette	39°	41.50'	018°	16.98'	03:59	04:13		2	
GeoB 10713-2		22/06/2006	Planktonnet	39°	41.50'	018°	16.98'	04:01	04:36		2	10.0
GeoB 10713-3		22/06/2006	MUC	39°	41.49'	018°	16.99'	04:31	04:39	04:31	2	127.3
GeoB 10714	681	22/06/2006		39°	38.41'	018°	16.96'	05:42			2	208.3
GeoB 10714-1		22/06/2006	CTD/Rosette	39°	38.42'	018°	16.98'	05:44	05:58		2	
GeoB 10714-2		22/06/2006	Planktonnet	39°	38.42'	018°	16.98'	05:46	06:20		2	10.0
GeoB 10714-3		22/06/2006	MUC	39°	38.41'	018°	17.00'	06:05	06:26	06:16	2	207.3
GeoB 10715	682	22/06/2006		39°	33.50'	018°	19.97'	07:27			2	697.3
GeoB 10715-1		22/06/2006	CTD/Rosette	39°	33.50'	018°	16.99'	07:28	08:02		2	
GeoB 10715-2		22/06/2006	Planktonnet	39°	33.50'	018°	17.00'	07:33	07:57		2	10.0
GeoB 10715-3		22/06/2006	MUC	39°	33.51'	018°	16,98'	08:05	08:38	08:22	2	697.3
GeoB 10716	683	22/06/2006		39°	20.71'	018°	16.97'	10:43			2	1328.3
GeoB 10716-1		22/06/2006	CTD/Rosette	39°	20.69'	018°	16.98'	11:08	12:00		2	
GeoB 10716-2		22/06/2006	Planktonnet	39°	20.70'	018°	16.99'	11:12	11:40		2	10.0
GeoB 10716-3		22/06/2006	MUC	39°	20.69'	018°	17.00'	12:02	12:54	12:33	2	1328.3
GeoB 10717	684	23/06/2006		39°	44.50'	018°	04.78'	03:59			2	96.3
GeoB 10717-1		23/06/2006	CTD/Rosette	39°	44.50'	018°	04.78'	04:01	04:12		2	
GeoB 10717-2		23/06/2006	Planktonnet	39°	44.50'	018°	04.78'	04:01	04:31		2	96.3
GeoB 10717-3		23/06/2006	MUC	39°	44.51'	018°	04.80'	04:16	04:31	04:23	2	96.3
GeoB 10718	685	23/06/2006		39°	41.56'	018°	03.48'	05:22			2	218.3
GeoB 10718-1		23/06/2006	CTD/Rosette	39°	41.56'	018°	03.48'	05:23	05:45		2	
GeoB 10718-2		23/06/2006	Planktonnet	39°	41.56'	018°	03.48'	05:23	06:05		2	10.0
GeoB 10718-3		23/06/2006	MUC	39°	41.57'	018°	03.48'	05:48	06:09	06:01	2	219.3
GeoB 10718-4		23/06/2006	MUC	39°	41.57'	018°	03.47'	06:17	06:35	06:26	2	220.3
GeoB 10719	686	23/06/2006		39°	39.20'	018°	02.48'	07:11			2	618.3
GeoB 10719-1		23/06/2006	CTD/Rosette	39°	39.19'	018°	02.49'	07:23	07:52		2	
GeoB 10719-2		23/06/2006	Planktonnet	39°	39.20'	018°	02.48'	07:28	07:55		2	10.0
GeoB 10719-3		23/06/2006	MUC	39°	39.20'	018°	02.50'	07:55	08:23	08:12	2	616.3
GeoB 10720	687	23/06/2006		39°	30.47'	017°	58.70'	10:05			2	1389.3
GeoB 10720-1		23/06/2006	CTD/Rosette	39°	30.46'	017°	58.70'	10:06	11:04		2	
GeoB 10720-2		23/06/2006	Planktonnet	39°	30.46'	017°	58.70'	10:10	10:34		2	10.0
GeoB 10720-3		23/06/2006	CTD/Rosette	39°	30.43'	017°	58.70'	11:26	11:35		2	
GeoB 10720-4		23/06/2006	Planktonnet	39°	30.43'	017°	58.70'	11:31			2	1388.3
GeoB 10720-5		23/06/2006	MUC	39°	30.40'	017°	58.70'	11:40	12:29	12:08	2	1387.3
GeoB 10720-6		23/06/2006	MUC	39°	30.40'	017°	58.72'	12:41	13:31	13:09	2	1388.3
transect 8a		24/06/2006	wp#4.1	41°	37.00'	017°	25.50'	16:11				
		24/06/2006	wp#4.2	41°	40.00'	017°	01.50'		18:57			
transect 8b		24/06/2006	wp#4.3	41°	46.00'	017°	07.00'	20:04				
		25/06/2006	wp#4.4	41°	48.50'	016°	31.50'		00:05			
GeoB 10721	689	25/06/2006		42°	10.00'	016°	45.98'	03:38			2	204.3
GeoB 10721-1		25/06/2006	CTD/Rosette	42°	09.99'	016°	45.98'	03:40	03:57		2	
GeoB 10721-2		25/06/2006	Planktonnet	42°	09.99'	016°	45.98'	03:42	04:15		2	10.0
GeoB 10721-3		25/06/2006	MUC	42°	09.98'	016°	46.00'	04:04	04:21	04:15	2	203.3
GeoB 10722	690	25/06/2006		42°	10.00'	016°	30.00'	06:10			2	142.3
GeoB 10722-1		25/06/2006	CTD/Rosette	42°	10.00'	016°	30.00'	06:11	06:25		2	
GeoB 10722-2		25/06/2006	Planktonnet	42°	10.00'	016°	29.98'	06:11	06:40		2	10.0
GeoB 10722-3		25/06/2006	MUC	42°	10.00'	016°	30.00'	06:28	06:40	06:34	2	142.3
GeoB 10723	691	25/06/2006		42°	09.99'	015°	59.97'	09:20			2	114.3
GeoB 10723-1		25/06/2006	CTD/Rosette	42°	09.99'	0.15°	59.98'	09:23	09:34		2	
GeoB 10723-2		25/06/2006	Planktonnet	42°	10.00'	0.15°	59.99'	09:25	09:45		2	10.0
GeoB 10723-3		25/06/2006	MUC	42°	10.00'	0.15°	59.99'	09:36	09:48	09:42	2	114.3
GeoB 10724	692	25/06/2006		42°	00.00'	016°	13.02'	11:46			2	49.2
GeoB 10724-1		25/06/2006	CTD/Rosette	42°	00.01'	0.16°	13.02'	11:47	11:56		2	
GeoB 10724-2		25/06/2006	Planktonnet	42°	00.01'	0.16°	13.02'	11:50	12:13		2	10.0
GeoB 10724-3		25/06/2006	MUC	42°	00.04'	0.16°	12.99'	12:00	12:08	12:02	2	49.5

GeoB 10725	693	25/06/2006		42°	00.00'	016°	22.04'	13:19			2	98.3	
GeoB 10725-1		25/06/2006	CTD/Rosette	42°	59.99'	0.16°	22.04'	13:20	13:32		2		
GeoB 10725-2		25/06/2006	Planktonnet	42°	59.98'	0.16°	22.03'	13:21	13:49		2	10.0	
GeoB 10725-3		25/06/2006	MUC	42°	59.98'	0.16°	21.99'	13:36	13:44	13:40	2	98.3	
GeoB 10726	694	26/06/2006		41°	59.99'	016°	42.95'	04:00			2	182.3	
GeoB 10726-1		26/06/2006	CTD/Rosette	41°	59.99'	0.16°	42.96'	04:01	04:16		2		
GeoB 10726-2		26/06/2006	Planktonnet	41°	59.99'	0.16°	42.96'	04:01	04:30		2	10.0	
GeoB 10726-3		26/06/2006	MUC	41°	59.99'	0.16°	43.01'	04:18	04:39	04:54	2	183.3	
GeoB 10727	695	26/06/2006		41°	48.01'	016°	37.03'	06:59			2	101.3	
GeoB 10727-1		26/06/2006	CTD/Rosette	41°	48.01'	0.16°	37.03'	07:00	07:08		2		
GeoB 10727-2		26/06/2006	Planktonnet	41°	48.04'	0.16°	37.02'	07:02	07:20		2	10.0	
GeoB 10727-3		26/06/2006	MUC	41°	48.03'	016°	37.00'	07:10	07:22	07:16	2	101.3	
GeoB 10728	696	26/06/2006		41°	46.99'	016°	51.44'	08:45			2	195.3	
GeoB 10728-1		26/06/2006	CTD/Rosette	41°	46.99'	016°	51.44'	08:46	09:02		2		
GeoB 10728-2		26/06/2006	Planktonnet	41°	46.97'	016°	51.44'	08:48	08:53		2	10.0	
GeoB 10728-3		26/06/2006	MUC	41°	47.00'	016°	51:50'	09:04	09:20	09:13	2	194.3	
GeoB 10729	697	26/06/2006		41°	38.76'	017°	11.50'	11:34			2	711.3	
GeoB 10729-1		26/06/2006	CTD/Rosette	41°	38.76'	017°	11.50'	11:35	12:09		2		
GeoB 10729-2		26/06/2006	Planktonnet	41°	38.76'	017°	11.49'	11:37	12:09		2	10.0	
GeoB 10729-3		26/06/2006	CTD/Rosette	41°	38.76'	017°	11.48'	12:20	12:29		2		
GeoB 10729-4		26/06/2006	MUC	41°	38.79'	017°	11.46'	12:31	13:03	12:48	2	712.3	
GeoB 10729-5		26/06/2006	SL	41°	38.77'	017°	11.51'	13:28	13:52	13:40	2	711.3	
GeoB 10729-6		26/06/2006	SL	41°	38.76'	017°	11.50'	14:05	14:31	14:19	2	711.3	225
transect 9		26/06/2006	wp#5.1	41°	38.50'	017°	37.50'	17:05					
		26/06/2006	wp#5.2	41°	30.00'	017°	20.50'	20:06					
		26/06/2006	wp#5.3	41°	30.02'	017°	01.38'		22:50				
GeoB 10730	699	27/06/2006		41°	30.02'	017°	03.01'	04:12			2	184.3	
GeoB 10730-1		27/06/2006	CTD/Rosette	41°	30.01'	017°	03.01'	04:14	04:29		2		
GeoB 10730-2		27/06/2006	Planktonnet	41°	30.00'	017°	03.00'	04:15	04:42		2	10.0	
GeoB 10730-3		27/06/2006	MUC	41°	29.99'	017°	03.00'	04:36	04:52	04:46	2	183.3	
GeoB 10731	700	27/06/2006		41°	29.96'	016°	39.49'	07:19			2	96.3	
GeoB 10731-1		27/06/2006	CTD/Rosette	41°	29.96'	016°	39.49'	07:20	07:30		2		
GeoB 10731-2		27/06/2006	Planktonnet	41°	29.96'	016°	39.49'	07:21	07:51		2	10.0	
GeoB 10731-3		27/06/2006	MUC	41°	29.98'	016°	39.49'	07:34	07:45	07:38	2	96.3	
GeoB 10731-4		27/06/2006	SL	41°	29.98'	016°	39.48'	07:55	08:04	07:59	2	96.3	
GeoB 10731-5		27/06/2006	SL	41°	29.99'	016°	39.49'	08:16	08:26	08:20	2	96.3	386
GeoB 10732	701	27/06/2006		41°	30.00'	016°	24.46'	10:00			2	50.9	
GeoB 10732-1		27/06/2006	CTD/Rosette	41°	30.00'	016°	24.46'	10:01	10:10		2		
GeoB 10732-2		27/06/2006	Planktonnet	41°	30.00'	016°	24.46'	10:02	10:21		2	10.0	
GeoB 10732-3		27/06/2006	MUC	41°	30.00'	016°	24.44'	10:12	10:21	10:16	2	50.7	
GeoB 10733	702	27/06/2006		41°	30.00'	016°	13.50'	11:34			2	22.5	
GeoB 10733-1		27/06/2006	CTD/Rosette	41°	30.00'	016°	13.50'	11:35	11:40		2		
GeoB 10733-2		27/06/2006	Planktonnet	41°	30.00'	016°	13.50'	11:36	11:42		2	10.0	
GeoB 10733-3		27/06/2006	MUC	41°	30.01'	016°	13.48'	11:53	12:00	11.56	2	22.5	
GeoB 10734	703	27/06/2006		41°	40.01'	016°	13.48'	13:27			2	18.2	
GeoB 10734-1		27/06/2006	CTD/Rosette	41°	39.99'	016°	14.48'	13:28	13:35		2		
GeoB 10734-2		27/06/2006	Planktonnet	41°	39.99'	016°	14.48'	13:29	13:49		2	10.0	
GeoB 10734-3		27/06/2006	MUC	41°	39.99'	016°	14.50'	13:40	13:45	13:42	2	18.2	
GeoB 10734-4		27/06/2006	SL	41°	39.97'	016°	14.47'	13:51	13:59	13:55	2	18.2	
GeoB 10734-5		27/06/2006	SL	41°	39.98'	016°	14.48'	14:09	14:13	14:11	2	18.1	270
GeoB 10735	704	28/06/2006		41°	29.98'	017°	18.51'	04:06			2	735.3	
GeoB 10735-1		28/06/2006	CTD/Rosette	41°	29.98'	017°	18.50'	04:08	04:42		2		
GeoB 10735-2		28/06/2006	Planktonnet	41°	29.98'	017°	18.48'	04:10	04:46		2	10.0	
GeoB 10735-3		28/06/2006	MUC	41°	30.00'	017°	18.50'	04:26	05:17	05:05	2	733.3	
GeoB 10735-4		28/06/2006	SL	41°	30.00'	017°	18.50'	05:26	05:54	05:42	2	733.3	257
GeoB 10736	705	29/06/2006		40°	45.52'	018°	11.50'	03:57			2	124.3	
GeoB 10736-1		29/06/2006	CTD/Rosette	40°	45.49'	018°	11.51'	03:59	04:11		2		
GeoB 10736-2		29/06/2006	Planktonnet	40°	45.46'	018°	11.54'	04:02	04:30		2	10.0	
GeoB 10736-3		29/06/2006	MUC	40°	45.50'	018°	11.50'	04:16	04:30	04:24	2	123.3	
GeoB 10737	706	29/06/2006		40°	37.51'	018°	19.75'	06:19			2	115.3	
GeoB 10737-1		29/06/2006	CTD/Rosette	40°	37.51'	018°	19.75'	06:19	06:31		2		
GeoB 10737-2		29/06/2006	Planktonnet	40°	37.51'	018°	19.75'	06:21	06:38		2	10.0	
GeoB 10737-3		29/06/2006	MUC	40°	37.50'	018°	19.72'	06:33	06:50	06:43	2	113.3	
GeoB 10738	707	29/06/2006		40°	32.73'	018°	27.97'	08:08			2	111.3	
GeoB 10738-1		29/06/2006	CTD/Rosette	40°	32.73'	018°	27.97'	08:09	08:20		2		

GeoB 10738-2		29/06/2006	Planktonnet	40°	32.73'	018°	27.97'	08:11	08:30		2	10.0	
GeoB 10738-3		29/06/2006	MUC	40°	32.74'	018°	27.99'	08:22	08:34	08:30	2	112.3	
GeoB 10739	708	29/06/2006		40°	29.97'	018°	38.47'	09:58			2	562.3	
GeoB 10739-1		29/06/2006	CTD/Rosette	40°	29.97'	018°	38.47'	10:00	10:33		2		
GeoB 10739-2		29/06/2006	Planktonnet	40°	29.97'	018°	38.47'	10:02	10:33		2	10.0	
GeoB 10739-3		29/06/2006	MUC	40°	30.00'	018°	38.49'	10:37	11:00	10:50	2	565.3	
GeoB 10740	709	29/06/2006		40°	23.51'	018°	34.98'	12:15			2	128.3	
GeoB 10740-1		29/06/2006	CTD/Rosette	40°	23.51'	018°	34.98'	12:16	12:26		2		
GeoB 10740-2		29/06/2006	Planktonnet	40°	23.51'	018°	34.99'	12:17	12:39		2	10.0	
GeoB 10740-3		29/06/2006	MUC	40°	23.51'	018°	34.99'	12:29	12:40	12:35	2	128.3	
GeoB 10741	710	29/06/2006		40°	14.03'	018°	39.98'	14:25			2	297.3	
GeoB 10741-1		29/06/2006	CTD/Rosette	40°	14.04'	018°	39.99'	14:26	14:48		2		
GeoB 10741-2		29/06/2006	Planktonnet	40°	14.05'	018°	39.98'	14:29	14:48		2	10.0	
GeoB 10741-3		29/06/2006	MUC	40°	14.00'	018°	39.99'	14:52	15:10	15:01	2	287.3	
transect 11	711	29/06/2006	wp#6.2	39°	50.50'	018°	37.00'	19:30					
		29/06/2006	wp#6.3	39°	39.00'	018°	51.50'		22:40				
GeoB 10742	712	30/06/2006		39°	42.87'	018°	46.58'	03:36			2	599.3	
GeoB 10742-1		30/06/2006	CTD/Rosette	39°	42.87'	018°	46.58'	03:38	04:06		2		
GeoB 10742-2		30/06/2006	Planktonnet	39°	42.87'	018°	46.58'	03:38	04:02		2	10.0	
GeoB 10742-3		30/06/2006	MUC	39°	42.98'	018°	46.58'	04:12	04:38	04:26	2	599.3	
GeoB 10742-4		30/06/2006	MUC	39°	42.90'	018°	46.59'	04:48	05:12	05:03	2	599.3	
GeoB 10743	713	30/06/2006		39°	49.53'	018°	38.48'	06:50			2	124.3	
GeoB 10743-1		30/06/2006	CTD/Rosette	39°	49.52'	018°	38.50'	06:52	07:05		2		
GeoB 10743-2		30/06/2006	Planktonnet	39°	49.50'	018°	38.50'	06:52	07:16		2	10.0	
GeoB 10743-3		30/06/2006	MUC	39°	49.49'	018°	38.53'	07:07	07:18	07:12	2	124.3	
GeoB 10744	714	30/06/2006		39°	51.02'	018°	35.96'	08:05			2	117.3	
GeoB 10744-1		30/06/2006	CTD/Rosette	39°	51.02'	018°	35.96'	08:06	08:16		2		
GeoB 10744-2		30/06/2006	Planktonnet	39°	51.02'	018°	35.98'	08:07	08:30		2	10.0	
GeoB 10744-3		30/06/2006	MUC	39°	51.00'	018°	35.99'	08:20	08:30	08:24	2	117.3	
GeoB 10745	715	30/06/2006		39°	48.50'	017°	43.98'	13:51			2	689.3	
GeoB 10745-1		30/06/2006	SL	39°	48.50'	017°	43.99'	13:53	14:19	14:08	2	688.3	
GeoB 10745-2		30/06/2006	Planktonnet	39°	48.50'	017°	43.98'	13:57	14:15		2	10.0	
GeoB 10745-3		30/06/2006	SL	39°	48.50'	017°	43.98'	14:28	14:53	14:42	2	689.3	485
GeoB 10746	716	31.06.2006		39°	54.50'	016°	45.54'	03:48			2	158.3	
GeoB 10746-1		31.06.2006	CTD/Rosette	39°	54.50'	016°	45.51'	03:51	04:08		2		
GeoB 10746-2		31.06.2006	Planktonnet	39°	54.50'	016°	45.51'	03:53	04:20		2	10.0	
GeoB 10746-3		31.06.2006	MUC	39°	54.51'	016°	45.49'	04:12	04:26	04:20	2	157.3	
GeoB 10746-4		31.06.2006	MUC	39°	54.50'	016°	45.50'	04:37	04:50	04:45	2	157.3	
GeoB 10746-5		31.06.2006	SL	39°	54.50'	016°	45.51'	04:59	05:10	05:05	2	157.3	338
GeoB 10747	717	31.06.2006		39°	43.50'	016°	58.51'	07:16			2	246.3	
GeoB 10747-1		31.06.2006	CTD/Rosette	39°	43.50'	016°	58.51'	07:16	07:36		2		
GeoB 10747-2		31.06.2006	Planktonnet	39°	43.49'	016°	58.49'	07:20	07:48		2	10.0	
GeoB 10747-3		31.06.2006	MUC	39°	43.49'	016°	58.49'	07:37	07:54	07:46	2	246.3	
GeoB 10748	718	31.06.2006		39°	39.99'	017°	03.02'	08:37			2	288.3	
GeoB 10748-1		31.06.2006	CTD/Rosette	39°	39.99'	017°	02.99'	08:40	09:00		2		
GeoB 10748-2		31.06.2006	Planktonnet	39°	39.98'	017°	02.99'	08:41	09:07		2	10.0	
GeoB 10748-3		31.06.2006	MUC	39°	39.99'	017°	02.99'	09:02	09:19	09:11	2	288.3	
GeoB 10749	719	31.06.2006		39°	35.99'	017°	10.99'	10:27			2	274.3	
GeoB 10749-1		31.06.2006	CTD/Rosette	39°	35.99'	017°	10.99'	10:28	10:47		2		
GeoB 10749-2		31.06.2006	Planktonnet	39°	35.99'	017°	11.01'	10:31	10:56		2	10.0	
GeoB 10749-3		31.06.2006	MUC	39°	36.00'	017°	10.99'	10:50	11:04	10:57	2	279.3	
GeoB 10749-4		31.06.2006	MUC	39°	36.02'	017°	10.98'	11:28	11:41	11:35	2	278.3	
GeoB 10750	718	31.06.2006		39°	30.00'	017°	30.00'	14:15			2	1141.3	
GeoB 10750-1		31.06.2006	Poseidini	39°	30.00'	017°	30.00'	14:20	14:30		2	1141.3	

Table 2. MUC positions

Station No.	GeoB No.	Date	Bottom contact [UTC]	Working area	Transect	Latitude [°N]	Longitude [°E]	Water depth [m]	Wire length [m]	Oxidized layer [cm]	Recovery [cm]	Lithology	Remarks	BF Leipzig [cm]	BF Utrecht [cm]	Clay Leipzig [cm]
666	10701-4	18/06/2006	05:25	E´ Golfo di Taranto	1	40°00.00´	017°28.01´	1187	1264	11.0	47	mud		0-10[a]	0-10[a]	10-11
667	10702-3	18/06/2006	09:50	E´ Golfo di Taranto	1	40°00.01´	017°35.15´	910	965	6.0	60	mud	slightly disturbed	0-10[a]		0-5
668	10703-3	18/06/2006	12:23	E´ Golfo di Taranto	1	40°00.00´	017°44.48´	273	289	7.0	48	mud		0-10[a]	0-10[a]	0-5
668	10703-4	18/06/2006	13:04	E´ Golfo di Taranto	1	40°00.00´	017°44.49´	273	290	7.0	56	mud				
670	10704-3	19/06/2006	05:47	E´ Golfo di Taranto	1	40°00.00´	017°50.00´	215	230	1.5	46	mud		0-10[a]		0-5
671	10705-3	19/06/2006	09:50	E´ Golfo di Taranto	2	39°51.20´	017°54.76´	124	132	3.0	42	mud		0-10[a]		0-5
672	10706-3	19/06/2006	11:47	E´ Golfo di Taranto	2	39°49.51´	017°50.01´	214	228	2.5	57	mud	variable recovery	0-10[a]		0-5
673	10707-4	20/06/2006	05:28	E´ Golfo di Taranto	2	39°47.00´	017°35.00´	1599	1712	6.0	46	mud		0-10[a]		0-5
674	10708-3	20/06/2006	08:13	E´ Golfo di Taranto	2	39°48.50´	017°43.99´	682	731	1.0	51	mud		0-10[a]		0-5
675	10709-4	20/06/2006	11:29	E´ Golfo di Taranto	3	39°45.41´	017°53.56´	168	179	4.0	35	mud	1 tube empty	0-10[a]	0-10[a]	0-5
675	10709-5	20/06/2006	11:56	E´ Golfo di Taranto	3	39°45.40´	017°53.58´	168	179	4.0	50	mud	1 tube empty			
676	10710-4	21/06/2006	05:55	E´ Golfo di Taranto	3	39°35.50´	017°41.00´	2036	2183	4.0	38	mud, sandy mud, sandy silt	2 turbidites	0-10[a]		0-5
677	10711-3	21/06/2006	09:14	E´ Golfo di Taranto	3	39°41.00´	017°47.99´	1045	1116	13.0	33	mud, for.+pterop. bearing		0-10[a]		0-5
678	10712-3	21/06/2006	12:24	E´ Golfo di Taranto	3	39°43.59´	017°51.69´	614	658	4.0	42	mud		0-10[a]	0-10[a]	0-5
680	10713-3	22/06/2006	04:30	E´ Golfo di Taranto	4	39°41.51´	018°17.02´	123	131	4.0	20	sandy mud to sand		0-10[a]		0-5
681	10714-3	22/06/2006	06:16	E´ Golfo di Taranto	4	39°38.41´	018°17.00´	202	217	3.0	26	sandy mud		0-10[a]		0-5
682	10715-3	22/06/2006	08:24	E´ Golfo di Taranto	4	39°33.51´	018°16.98´	693	739	20.0	27	sandy mud	turbidite at base	0-10[a]		0-5
683	10716-3	22/06/2006	12:33	E´ Golfo di Taranto	4	39°20.70´	018°17.01´	1325	1413	14.0	24	sandy mud		0-10[a]		0-5
684	10717-3	23/06/2006	04:20	E´ Golfo di Taranto	5	39°44.51´	018°04.80´	92	98	4.0	26	sandy mud to sand		0-5[c]		5-7
685	10718-3	23/06/2006	06:00	E´ Golfo di Taranto	5	39°41.57´	018°03.49´	214	235		0		no samples			
685	10718-4	23/06/2006	06:27	E´ Golfo di Taranto	5	39°41.57´	018°03.48´	214	238	7.0	32	sandy mud		0-5[c]		5-7
686	10719-3	23/06/2006	08:12	E´ Golfo di Taranto	5	39°39.20´	018°02.50´	612	661	3.0	35	mud		0-5[c]		5-7
687	10720-5	23/06/2006	12:08	E´ Golfo di Taranto	5	39°30.41´	017°58.70´	1384	1474		0		no samples			
687	10720-6	23/06/2006	13:09	E´ Golfo di Taranto	5	39°30.41´	017°58.73´	1384	1476	17.0	30	mud		0-5[c]		5-7
689	10721-3	25/06/2006	04:13	Golfo di Manfredonia	6	42°10.00´	016°46.00´	200	212	7.0	20	sandy mud to sand		0-5[c]		5-7
690	10722-3	25/06/2006	06:35	Golfo di Manfredonia	6	42°09.99´	016°30.00´	138	146	6.0	20	sandy mud	1 tube empty	0-5[c]		5-7
691	10723-3	25/06/2006	09:42	Golfo di Manfredonia	6	42°10.00´	015°59.99´	110	117	3.0	43	mud		0-5[c]		5-7
692	10724-3	25/06/2006	12:03	Golfo di Manfredonia	7	42°00.03´	016°12.99´	45	47	4.0	34	sandy mud to sand		0-5[c]		5-7
693	10725-3	25/06/2006	13:40	Golfo di Manfredonia	7	42°00.03´	016°12.99´	94	99	4.0	47	mud		0-5[c]		5-7
694	10726-3	26/06/2006	04:30	Golfo di Manfredonia	7	42°00.00´	016°43.01´	179	191	3.0	11	sandy mud to sand	2 cores disturbed	0-5[c]		5-7
695	10727-3	26/06/2006	07:16	Golfo di Manfredonia	8	41°48.03´	016°37.00´	97	103	4.0	39	sandy mud		0-5[c]		5-7
696	10728-3	26/06/2006	09:13	Golfo di Manfredonia	8	41°47.00´	016°51.50´	191	203	11.0	11	sandy mud to sand		0-5[c]		5-7
697	10729-4	26/06/2006	12:48	Golfo di Manfredonia	8	41°38.79´	017°11.47´	708	753	15.0	29	sandy mud, mud		0-5[c]		5-7
699	10730-3	27/06/2006	04:45	Golfo di Manfredonia	9	41°29.99´	017°03.00´	179	191	7.0	17	sandy mud to sand		0-10[a]		2-5
700	10731-3	27/06/2006	07:38	Golfo di Manfredonia	9	41°29.98´	016°39.49´	93	99	4.0	52	mud		0-10[a]	0-10[a]	2-5
701	10732-3	27/06/2006	10:16	Golfo di Manfredonia	9	41°30.00´	016°24.45´	46.5	48	5.0	38	mud		0-10[a]		2-5
702	10733-3	27/06/2006	11:56	Golfo di Manfredonia	9	41°30.01´	016°13.46´	18.3	18	2.0	41	mud		0-10[a]		2-5
703	10734-3	27/06/2006	13:41	Golfo di Manfredonia	8	41°40.00´	016°14.49´	13.8	13	4.0	39	mud		0-5[c]		2-5
704	10735-3	28/06/2006	05:04	Golfo di Manfredonia	8	41°30.01´	017°18.50´	730	777	27.0	49	mud		0-10[a]	0-10[a]	2-5
705	10736-3	29/06/2006	04:24	off Brindisi-Otranto	10	40°45.50´	018°11.51´	119	128	3.0	55	mud		0-5[c]		5-7
706	10737-3	29/06/2006	06:44	off Brindisi-Otranto	10	40°37.50´	018°19.73´	109	117	3.0	44	mud		0-5[c]		5-7
707	10738-3	29/06/2006	08:29	off Brindisi-Otranto	10	40°32.75´	018°27.99´	108	115	4.0	41	mud		0-5[c]		5-7
708	10739-3	29/06/2006	10:50	off Brindisi-Otranto	10	40°30.00´	018°38.50´	561	595	4.0	38	mud		0-5[c]		5-7
709	10740-3	29/06/2006	12:35	off Brindisi-Otranto	10	40°23.51´	018°35.00´	124	131	5.0	26	sandy mud to sand		0-5[c]		5-7
710	10741-3	29/06/2006	15:01	off Brindisi-Otranto	10	40°14.01´	018°39.99´	286	310	2.0	37	sandy mud		0-5[c]		5-7
712	10742-3	30/06/2006	04:25	off Capo di S. Maria di Leuca	11	39°42.90´	018°46.59´	595	633	18.0	30	mud, foram.-bearing	8 tubes empty, no samples			
712	10742-4	30/06/2006	05:02	off Capo di S. Maria di Leuca	11	39°42.90´	018°46.59´	595	633	18.0	37	mud, foram.-bearing		0-5[c]		2-5
713	10743-3	30/06/2006	07:13	off Capo di S. Maria di Leuca	11	39°49.50´	018°38.54´	120	128	12.0	34	sandy mud		0-5[c]		2-5
714	10744-3	30/06/2006	08:25	off Capo di S. Maria di Leuca	11	39°51.00´	018°35.99´	113	121	3.0	42	mud		0-5[c]		2-5
716	10746-3	01/07/2006	04:20	W´ Golfo di Taranto	12	39°54.51´	016°45.49´	153	164	2.0	51	mud	1 core disturbed			
716	10746-4	01/07/2006	04:45	W´ Golfo di Taranto	12	39°54.50´	016°45.50´	153	163	2.0	53	mud		0-10[a]	0-10[a]	2-5
717	10747-3	01/07/2006	07:47	W´ Golfo di Taranto	12	39°43.49´	016°58.49´	242	257	5.0	53	mud		0-5[c]		2-5
718	10748-3	01/07/2006	09:11	W´ Golfo di Taranto	12	39°39.99´	017°03.00´	284	302	3.0	46	mud		0-5[c]		2-5
719	10749-3	01/07/2006	10:58	W´ Golfo di Taranto	12	39°36.01´	017°10.99´	275	292	4.0	34	mud		0-5[c]		2-5
719	10749-4	01/07/2006	11:35	W´ Golfo di Taranto	12	39°36.01´	017°10.99´	275	292	4.0	34	mud				

Sample strategy Benthic Foraminifers (BF)
0-10 cm[a] Tube Ø = 9.5 cm; Intervals: 0-0.5, 0.5-1, 1-2, ... ,9-10 cm + Ethanol +Rose Bengal
0-10 cm[b] Tube Ø = 6 cm; Intervals: 0-0.5, 0.5-1, 1-2, ... ,9-10 cm + Ethanol +Rose Bengal
0-5 cm[c] Tube Ø = 6 cm; Interval 0-5 cm + Ethanol +Rose Bengal

Table 3 Tabulated results of colour measurements on MUC surface sediments (0-1cm)

Station				top	bot	L*	a*	b*
Station	Lattitude (N)	Longitude (E)	Water depth	depth	bot	L*	a*	b*
107-01	40.0000	17.4658	1183	0	1	48.54	-0.11	10.61
107-02	40.0000	17.5917	933	0	1	49.98	2.96	14.86
107-02	40.0000	17.5917	933	0	1	50.99	2.09	14.6
107-03	39.9999	17.7413	273	0	1	52.34	0.09	11.73
107-03	39.9999	17.7413	273	0	1	50.52	-0.06	11.15
107-03	39.9999	17.7413	273	1	2	58.52	11.78	22.99
107-03	39.9999	17.7413	273	2	3	46.65	2.88	14.49
107-03	39.9999	17.7413	273	3	4	45.02	3.2	13.53
107-03	39.9999	17.7413	273	4	5	43.73	3	14.09
107-03	39.9999	17.7413	273	5	6	51.35	0.06	10.99
107-03	39.9999	17.7413	273	6	7	48.29	2.25	14.44
107-03	39.9999	17.7413	273	7	8	52.2	0.11	11.26
107-03	39.9999	17.7413	273	8	9	50.55	1.1	13.63
107-03	39.9999	17.7413	273	9	10	51.39	0.51	12.57
107-03	39.9999	17.7413	273	10	11	46.79	-0.25	7.82
107-03	39.9999	17.7413	273	11	12	51.94	-0.2	10.96
107-03	39.9999	17.7413	273	12	13	50.76	0.35	12.36
107-03	39.9999	17.7413	273	13	14	50.59	0.33	12.18
107-03	39.9999	17.7413	273	14	15	42.62	-0.53	7.86
107-03	39.9999	17.7413	273	15	16	50.81	0.13	11.57
107-03	39.9999	17.7413	273	16	17	51.37	-0.19	10.88
107-03	39.9999	17.7413	273	17	18	45.98	-0.23	9.08
107-03	39.9999	17.7413	273	18	19	46.11	2.59	14.53
107-03	39.9999	17.7413	273	19	20	46.37	3.6	14.94
107-03	39.9999	17.7413	273	20	21	52.27	0.07	11.74
107-03	39.9999	17.7413	273	21	22	47.84	0.19	10.67
107-03	39.9999	17.7413	273	22	23	52.04	0.12	11.6
107-03	39.9999	17.7413	273	23	24	49.52	1.48	13.78
107-03	39.9999	17.7413	273	24	25	51.79	0.15	11.41
107-03	39.9999	17.7413	273	25	26	47.54	2.95	14.95
107-03	39.9999	17.7413	273	26	27	51.54	0.11	11.44
107-03	39.9999	17.7413	273	27	28	50.74	0.44	12.19
107-03	39.9999	17.7413	273	28	29	51.3	0.26	11.79
107-03	39.9999	17.7413	273	29	30	51.18	-0.05	11
107-04	40.0002	17.8337	215	0	1	49.84	3.16	15.28
107-05	39.8533	17.9127	124	0	1	50.94	2.09	14.81
107-06	39.8250	17.8335	214	0	1	49.31	2.66	14.94
107-06	39.8250	17.8335	214	0	1	50.54	2.17	14.63
107-06	39.8250	17.8335	214	0	2	50.53	2.2	14.95
107-07	39.7833	17.5835	1587	0	1	52.34	1.91	13.74
107-07	39.7833	17.5835	1587	0	1	49.22	2.84	14.8
107-07	39.7833	17.5835	1587	0	1	40.53	2.17	12.04
107-08	39.8083	17.7337	681	0	1	49.93	3.3	15.09
107-08	39.8083	17.7337	681	0	1	50.75	1.97	14.64
107-08	39.8083	17.7337	681	0	1	50.92	2.02	14.36
107-08	39.8083	17.7337	681	0	1	50.27	3.27	14.94
107-11	39.6832	17.8000	1046	0	1	50.76	4.38	16.49
107-12	39.7264	17.8616	617	0	1	50.22	2.51	15.12

107-13	39.6918	18.2837	131	0	1	50.53	1.78	13.87
107-14	39.6403	18.2830	204	0	1	48.1	2.77	14.26
107-15	39.6417	18.2830	693	0	1	49.96	3.91	15.79
107-16	39.3450	18.2828	1325	0	1	51.66	4.75	16.54
107-17	39.7418	18.0800	98	0	1	48.47	2.11	13.35
107-17	39.7418	18.0800	98	0	1	47.15	3.45	13.81
107-17	39.7418	18.0800	98	1	2	46.84	3.39	13.31
107-17	39.7418	18.0800	98	2	3	42.32	4.55	13.4
107-17	39.7418	18.0800	98	3	4	42.43	4.14	13.33
107-17	39.7418	18.0800	98	4	5	46.67	0.41	9.51
107-17	39.7418	18.0800	98	5	6	46.74	0.49	10.03
107-17	39.7418	18.0800	98	6	7	44.62	0.27	8.39
107-17	39.7418	18.0800	98	7	8	44.79	0.1	8.03
107-17	39.7418	18.0800	98	8	9	40.59	0.24	7.6
107-17	39.7418	18.0800	98	9	10	43.45	0.26	8.21
107-17	39.7418	18.0800	98	10	11	43.41	0.39	8.3
107-17	39.7418	18.0800	98	10	11	43.81	-0.09	7.79
107-17	39.7418	18.0800	98	11	12	44.05	0.15	8.2
107-17	39.7418	18.0800	98	12	13	42.76	0.25	7.62
107-17	39.7418	18.0800	98	14	15	43.1	-0.03	7.34
107-17	39.7418	18.0800	98	15	16	43.01	0.28	7.87
107-17	39.7418	18.0800	98	16	17	41.44	-0.08	6.95
107-17	39.7418	18.0800	98	16	17	46.81	-0.09	8.41
107-17	39.7418	18.0800	98	17	18	47.51	0.12	9.1
107-17	39.7418	18.0800	98	18	19	43.45	0.31	8.22
107-17	39.7418	18.0800	98	20	21	50.12	0.99	12.05
107-17	39.7418	18.0800	98	21	22	50.9	1.37	13.85
107-17	39.7418	18.0800	98	22	23	50.26	1.05	12.77
107-17	39.7418	18.0800	98	23	24	49.94	0.83	11.81
107-17	39.7418	18.0800	98	24	25	49.64	0.88	11.76
107-17	39.7418	18.0800	98	25	26	46.98	0.42	9.58
107-17	39.7418	18.0800	98	26	27	45.27	0.38	8.29
107-17	39.7418	18.0800	98	28	29	46.79	0.37	9.43
107-17	39.7418	18.0800	98	29	30	46.17	0.2	8.62
107-17	39.7418	18.0800	98	30	31	42.11	0.36	8.17
107-17	39.7418	18.0800	98	31	32	42.23	0.22	8.03
107-17	39.7418	18.0800	98	32	33	46.91	0.29	9.42
107-17	39.7418	18.0800	98	33	34	45.35	0.3	10.57
107-18	39.6927	18.0582	215	0	1	51.64	1.52	14.18
107-19	39.6532	18.0415	612	0	1	51.88	2.33	14.13
107-20	39.5078	17.9783	1382	0	1	54.89	3.11	15.33
107-20	39.5078	17.9783	1382	1	2	54.96	3.14	14.59
107-20	39.5078	17.9783	1382	2	3	57.33	2.52	14.44
107-20	39.5078	17.9783	1382	3	4	57.07	2.09	13.49
107-20	39.5078	17.9783	1382	4	5	57.47	1.9	13.7
107-20	39.5078	17.9783	1382	5	6	58.42	2.21	14.81
107-20	39.5078	17.9783	1382	6	7	57.11	1.89	13.33
107-20	39.5078	17.9783	1382	7	8	56.97	2.14	14.37
107-20	39.5078	17.9783	1382	8	9	56.16	1.95	13.38
107-20	39.5078	17.9783	1382	9	10	55.72	2.12	13.46
107-20	39.5078	17.9783	1382	10	11	55.93	1.64	12.73
107-21	42.1665	16.7663	200	0	1	49.18	3.54	15.3

107-22	42.1668	16.4997	138	0	2	51.37	2.23	15.01
107-23	42.1665	15.9997	117	0	1	50.62	2.85	15.73
107-24	42.0000	16.2170	45	0	2	50.09	1.13	12.24
107-25	42.0000	16.3672	94	0	1	51.24	1.77	14.76
107-26	41.9998	16.7162	179	0	2	48.5	2.33	13.5
107-27	41.8006	16.6170	79	0	2	51.98	1.92	15.47
107-28	41.7830	16.8574	175	0	2	43.94	4.07	12.67
107-29	41.6460	17.1916	708	0	1	49.45	3.54	15.66
107-29	41.6460	17.1916	708	1	2	49.16	3.67	15.64
107-29	41.6460	17.1916	708	2	3	48.71	3.46	14.4
107-29	41.6460	17.1916	708	3	4	48.39	3.54	14.11
107-29	41.6460	17.1916	708	4	5	48.15	3.79	14.35
107-29	41.6460	17.1916	708	5	6	47.47	3.88	14.39
107-29	41.6460	17.1916	708	6	7	47.29	3.09	13.66
107-29	41.6460	17.1916	708	7	8	50.14	2.8	14.88
107-29	41.6460	17.1916	708	8	9	53.56	2.45	15.3
107-29	41.6460	17.1916	708	9	10	54.48	1.74	14.21
107-29	41.6460	17.1916	708	10	11	54.02	1.84	14.68
107-29	41.6460	17.1916	708	11	12	54.6	0.76	12.89
107-29	41.6460	17.1916	708	12	13	55.85	1.62	14.35
107-29	41.6460	17.1916	708	13	14	55.81	1.1	13.29
107-29	41.6460	17.1916	708	14	15	56.38	0.61	13.06
107-29	41.6460	17.1916	708	15	16	55.15	0.41	12.62
107-29	41.6460	17.1916	708	16	17	56.36	0.99	13.64
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107-29	41.6460	17.1916	708	20	21	55.96	0.27	12.26
107-30	41.5000	17.0502	155	0	2	47.52	2.59	13.35
107-31	41.4995	16.6578	93	0	1	51.77	2.28	15.94
107-32	41.5004	16.4077	46	0	1	51.61	1.71	15.02
107-33	41.5003	16.2250	22	0	1	50.13	1.43	13.37
107-34	41.6673	16.2407	19	0	1	50.32	1.39	13.03
107-35	41.4998	17.3082	730	0	1	49.63	3.72	15.78
107-36	40.7578	18.1923	119	0	1	49.67	2.94	15.49
107-37	40.6253	18.3290	112	0	1	51.33	1.71	14.44
107-38	40.5456	18.4663	107	0	1	49.44	2.74	15.03
107-39	40.4996	18.6413	558	0	1	49.73	2.74	14.55
107-40	40.3918	18.5832	124	0	2	47.58	2.54	13.68
107-41	40.2341	18.6666	306	0	1	49.95	2.04	14.73
107-41	40.2341	18.6666	306	1	2	51.11	0.46	12.83
107-41	40.2341	18.6666	306	2	3	50.95	0.82	13.33
107-41	40.2341	18.6666	306	3	4	51.08	0.37	12.6
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107-42	39.7146	18.7764	595	0	1	50.63	3.83	15.67
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107-47	39.7249	16.9749	242	0	1	47.23	3.74	14.94
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107-48	39.6665	17.0501	284	1	2	51.07	2.74	15.56
107-48	39.6665	17.0501	284	2	3	50.96	2.55	14.96
107-48	39.6665	17.0501	284	3	4	50.54	2.01	13.83
107-48	39.6665	17.0501	284	4	5	49.6	2.18	13.88
107-49	39.6000	17.1836	270	0	1	48.99	3.81	15.48

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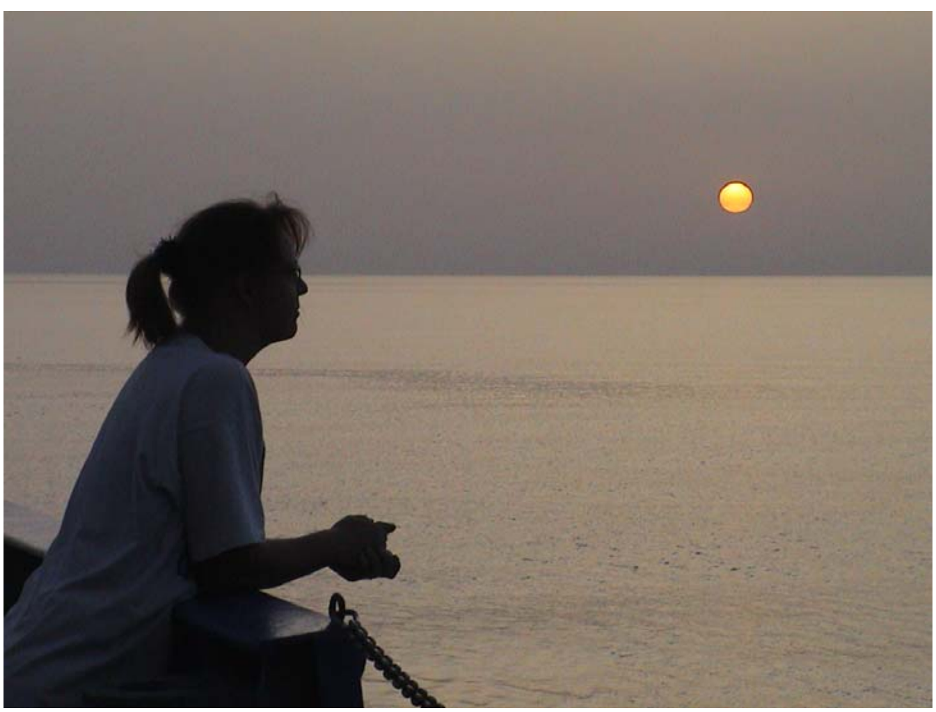

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